PESTICIDES ABSTRACTS

April 1976 - Vol. 9, No. 4

Abstracts 76-0840-1088

PSTAB 09(04) 247-313 (1976)

U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDE PROGRAMS
TECHNICAL SERVICES DIVISION
Rm. EB-49, 401 M Street, S.W.
Washington, D.C. 20460

PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Technical Services Division of the Office of Pesticide Programs, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

Publication of an abstract, annotation, or citation does not imply endorsement by the Environmental Protection Agency of the original article or of commercial materials, equipment, or processes mentioned therein.

CONTENTS

Volume 9 April 1976 No. 4

Page

General 247
(News items, letters, and editorials appearing in scientific and technical journals; information on production and use; and other items of general interest)

Monitoring and Residues 250
(Levels of pesticides in people or nonexperimental animals or in water, air, soil, food, feed, and other consumer products)

Epidemiology, Prevention and Treatment 264
(Frequency and distribution of pesticide poisoning in man or nonexperimental animals and treatment of clinical cases; morbidity and mortality; safety measures; decontamination; disposal of containers and wastes; legislation and regulations)

Toxicology and Pharmacology 269
(Toxicity studies in man and animals; effects on cells; organs, and systems; metabolic studies, biochemistry, interactions; antidotes and other treatment; mode of action. Ordinarily, articles dealing with efficacy studies are not included.)

Analysis 304
(Preparation of samples; analytical methods; instrumentation

76-0840. Geier, P. W.; Springett, B. P. (Div. Entomol., CSIRO, Canberra City, A.C.T., Australia). **The context of pest control.** *Agric. Environ.* 1(4): 373-383; 1974. (18 references)

Three broad approaches to pest control are evident worldwide: the opportunistic, which is the approach of the developing countries; the gradualist; and the holistic or systemic. The main constraint of the opportunist approach is urgency, and its means are judged solely on their direct effectiveness. The tenet of the gradualist approach is that improvement must accrue little by little through the conventional scientific method of experimentation, making hypotheses and testing them over indefinite periods of time. According to the systemic approach, advances of the kind needed demand a radical departure in thought and action, to be achieved in a short, critical span of time; pest situations are accepted as wholly ecological phenomena. As a rule, the opportunistic approach is adopted from force of circumstances, whereas the others present an option for affluent and informed communities. All of these approaches have serious deficiencies, and the contexts molding future pest control will be determined according to the socioeconomic and political circumstances resulting from evolutionary trends particular to each historical community. A new approach to pest control is needed, which should be based on the fact that pest control in all its medical, veterinary, and phytosanitary aspects forms a special branch of engineering, which could be termed Protection Ecology. As an integrative, mission-oriented discipline in its own right, Protection Ecology should have its own primate, official, subprofessional, and graduate practitioners, its own governing bodies and public administration, and its special research institutes and separate training establishments.

76-0841. Jones, D. P. (Author address not given). **The changing pattern of pesticide research and development.** *Biologist* 21(4): 179-181; 1974.

The costs of research and development of pesticides, from initial compound screening to product launch, increased from 1950 to 1970. These costs also include toxicologic studies, the construction of pilot plants, and the first production of the compound. Inflation is responsible for some of the increase but the costs of the work involved in the discovery and development of a new product have increased enormously. New pesticides must be superior in cost-effectiveness and achieve higher standards of environmental integration than earlier materials. The enormous volume of chemical synthesis in many industrial fields has encouraged a big increase in random screening. Field evaluation and development of a candidate pesticide is now a major undertaking. Conditions of usage must be carefully investigated and recommendations made extremely clear and precise. If the product under consideration also involves a new approach to crop husbandry, additional development efforts are required. About 30% of the costs of product research and development are needed to meet increased demands for information on toxicology. Chemical development also makes strong demands on resources. These rising costs and the lengthened lead time have had effects within the industry. It is now a long time before an investment can bring its expected financial returns. Lead time is about half the patent life, thus leaving a very limited period for a company to recover its investment. Many small firms are unable to cope with these changes. Large firms have started using independent laboratories to relieve the work load, exploit special expertise, or merely ensure the results of independent evaluation to accompany their own submissions to the registration authorities.

76-0842. Long, J. E. (Author address not given). **EPA runs into more flak over pesticides.** *Chem. Eng. News* 54(7): 19-20; 1976.

The Environmental Protection Agency has been accused of refraining from vigorous enforcement of controls on available toxic substances and of retrenchment from the few legal precedents it has set for evaluation of cancer hazards posed by chemicals. This has been attributed to industry pressure and election-year politics. A random investigation of 100 pesticides containing 36 active chemical ingredients showed that mutagenicity data was lacking for 64, teratogenicity data for 39, reproductive data for 19, and chronic feeding data for 19. Efficacy data was lacking for 42 of 93 pesticides sampled. Of 32 pesticides sampled for which environmental chemistry data was required, 11 lacked data on degradation in soil, 17 on degradation in water, and 17 on photochemical degradation. Microbiological data was lacking for 16, leaching data for 24, and runoff data for 24. It was acknowledged that part of the problem with EPA's pesticide registration program is the sheer volume of the task facing the agency.

76-0843. Kevan, P. G. (Memorial Univ. Newfoundland, St. John's, Newfoundland, Canada). **Pollution and environmental conservation.** *Environ. Conserv.* 2(4): 293-298; 1975. (34 references)

Caution must be exercised in the continued use of pesticides due to their devastating effects on some nontarget organisms and their disruption of the naturally established course of events within ecosystems. New, more biodegradable, or otherwise less persistent pesticides with increased target specificity may provide some solutions to the problems. However, far more comprehensive testing of these new pesticides and those already in use is needed. The broad application of insecticides probably has more profound direct effects on the natural assemblage of insects, whether they be beneficial or harmful, than on the vertebrate fauna with which many people are more concerned. However, the problem is not limited to insecticides. Herbicides can and do have similarly direct poisonous effects. Herbicides may also indirectly affect pollinators and other insects that are dependent on flowers. The role of wildflowers in maintaining some insect populations is not always realized. Some fungicides and

insecticides have also been shown to reduce the viability of pollen, and so the fecundity of the plant is reduced.

76-0844. Anonymous. **New journal announcement.** *J. Toxicol. Environ. Health* 1(1): I-II; 1975.

The Journal of Toxicology and Environmental Health will publish original papers and brief progress reports on the induction and expression of toxicological phenomena and associated human risk to environmental insults, and papers pertaining to the safety evaluation of therapeutic, industrial, and environmental agents. Timely reviews of subjects and books of interest to toxicologists and pharmacologists will also be accepted. Manuscripts should be concise but detailed and should contain an abstract, introduction, methods section, results section, discussion and conclusion, and references. Details for the inclusion of footnotes, tables, and figures are given, as are details relating to page and author charges, proofs, and reprints. One of the criteria for judging acceptability for publication of controversial issues is their importance as matters of international and national concern. The Journal of Toxicology and Environmental Health will publish manuscripts of major significance to society for the purpose of airing controversial subjects without undue editorial restriction. Technical articles consistent with the scope of the journal will be accepted for publication only if they meet rigorous scientific standards.

76-0845. Miranowski, J. A.; Ernst, U.; Cummings, F. H. (ABT Associates, Inc., Cambridge, MA 02138). **Crop insurance and information services to control use of pesticides.** *Natl. Tech. Inform. Serv.*, PB-238 356, 1974, 93 p. (24 references)

This study analyzes the relative effectiveness and efficiency of pest information and crop insurance programs in encouraging farmers to use potentially harmful pesticides more sparingly by eliminating wasteful applications. Possibly excessive applications of pesticides can be attributed to poor timing of applications and to the risk-averse behavior of farmers. Focusing on insecticide use in cotton production as a major policy problem, the study employs a decision-theoretic framework to simulate the farmer's pesticide use decisions under alternative program options and subsidy levels. To the extent possible, empirical data is analyzed to complement the findings of the simulation analysis. The theoretical and empirical analyses in this study indicate that past information programs are potentially more effective than crop insurance programs in reducing insecticide usage. These reductions from compliance with pest control recommendations provided by information programs are associated with economic gains by the farmer. Both the simulation experiments and available evaluations of the USDA Pest Management Program indicate that a maximum insecticide use reduction of 30 percent can be achieved through information programs. Subsidies to such programs appear an effective means to encourage adoption by farmers, at least in the initial phases. (Author abstract by permission)

76-0846. Von Rumker, R.; Lawless, E. W.; Meiners, A. F. (Midwest Res. Inst., Kansas City, MO 64110). **Production, distribution, use and environmental impact potential of selected pesticides.** *Natl. Tech. Inform. Serv.*, PB-238 795, 1974, 453 p.

The production, distribution, use patterns, and potential for environmental impact of pesticides are described, with emphasis on 25 important pesticides selected by applying a priority rating system to 125 major pesticides. The pesticides discussed include the following insecticides: aldrin, carbaryl, carbofuran, chlordane, diazinon, disulfoton, malathion, methyl parathion, parathion, and toxaphene; the herbicides: alachlor, atrazine, bromacil, 2,4-D, diuron, MSMA, sodium chlorate, and trifluralin; the fungicides and wood preservatives: captan, creosote, maneb, and pentachlorophenol; and the fumigants: methyl bromide and dichlorobenzene. Topics under pesticide production, imports, exports, and domestic supplies include organic and inorganic pesticides, pesticide imports and exports, domestic supplies of pesticides, and estimated production, imports, exports and uses of the intensive-study pesticides. Topics discussed under the area of agricultural uses of pesticides include the USDA farm pesticide use reports, survey of the federal/state cooperative extension service, survey of the EPA community pesticide studies projects, survey of pesticide manufacturers, and pesticide data from other sources. Industrial, commercial, institutional, and governmental uses of pesticides are considered. Environmental impact potential of pesticides is discussed including topics of mammalian toxicity, toxicity to other nontarget organisms, and pesticide residues in the environment. The wasteful use practices of pesticides are presented including application losses, overuse, and unnecessary use. Several alternatives to chemical pesticides are considered including cultural methods, physical and mechanical methods, resistant crop varieties, predators and parasites, insect pathogens, sterilization, insect growth regulators, pheromones, antimetabolites and antifeeding agents, and integrated pest management.

76-0847. Patterson, J. W. (Dept. Environ. Eng., Illinois Inst. Technol., Chicago, IL 60616). **State-of-the-art for the inorganic chemicals industry: inorganic pesticides.** *Natl. Tech. Inform. Serv.*, PB-240 959, 1975, 67 p.

A literature and field study was made of the manufacture of inorganic pesticides. It appeared that the inorganic pesticide industry is a small but distinct segment of the total agricultural chemicals industry. Nineteen pesticides were identified in this study, of which 8 dominate the agricultural market; sulfur, sodium chlorate, and copper sulfate lead these. The principal inorganic pesticide

formulations include: insecticides, calcium arsenate, calcium cyanide, lead arsenate, sodium cyanide, and sodium fluoride; herbicides, ammonium sulfamate, arsenic acid, borates, magnesium chlorate, potassium chlorate, sodium arsenite, and sodium chlorate; and fungicides, cadmium chloride, copper carbonate, copper chloride, mercurous chloride, sodium polysulfide, sulfur, zinc oxide, and zinc sulfate. Most of the inorganic pesticides are manufactured by 2 or 3 companies. Companies associated with the sale of inorganic pesticides often do not make them, but purchase them in bulk and repackage them under their own labels. Mercury chlorides, most inorganic herbicides, and calcium arsenate have declined in popularity. Sulfur, sodium chlorate, copper sulfate, and lead arsenate use has held steady or only slightly decreased. Zinc sulfate use has increased in recent years; it is used primarily as a plant nutrient and secondarily as a fungicide. The following 7 pesticides can be manufactured without any associated wastewater effluent: arsenic acid, calcium arsenate, copper sulfate, lead arsenate, sodium arsenite, sulfur, and zinc sulfate. Sodium chlorate and sodium borate had significant wastewaters associated with their manufacture. In-plant process modifications can reduce mass pollutant discharges associated with sodium chlorate production by more than 99%. Copper carbonate manufacturing wastewaters are directly treatable by conventional precipitation techniques, with effluent quality equivalent to that achieved by other heavy metal processing industries. Tribasic copper sulfate wastewater is hard to treat due to its complexing nature. In general, it was concluded that there appears to be a significant capability for the inorganic pesticide industry to totally eliminate or greatly reduce pollutant discharge.

76-0848. Crossland, B. (Dep. Mechanical Engineering, Queen's Univ. Belfast, Ashby Inst., Belfast, Ireland). **The role of the mechanical engineer in the environmental problems of a developing technological society.** *Proc. Inst. Mech. Eng.* 189: 77-87; 1975. (12 references)

The threats to the future of human civilization may be divided into several related groups: the population explosion, the exhaustion of energy supplies, the exhaustion of raw materials, and pollution of the environment. Potential and real pollution problems arise from the excessive use of DDT, fertilizers, mercury, and aerosols. Although DDT has been partly responsible for a considerable increase in agricultural productivity and the eradication of malaria, there is growing concern because of its toxicity and the long-term effects of its storage in man and animals. In the 1960's, the DDT concentrations in human body tissues amounted to 12 ppm in Americans and up to 26 ppm in citizens of New Delhi. Concentrations of 3 ppm in some fishes and birds inhibits reproduction. While DDT offers considerable short-term advantages, if production continues at a rate of 150,000 tons/yr as in the late 1960's, these advantages may be completely nullified in the long term. The System Dynamics Groups at the Alfred P. Sloan School of Management at MIT has used systems analysis tools to study the movement of DDT in the global environment. The effect of a constant annual rate of DDT usage on the concentrations of DDT in the soil and fish was determined, and this data can be used to study the effect of various courses of control available. To promote awareness of threats to human civilization among engineering students, these problems should be introduced into existing courses of study.

76-0849. Knusli, E. (CIBA-GEIGY Ltd., Basel, Switzerland). **The future of the development of pesticides by industry.** *Pure Appl. Chem.* 42(1-2): 77-87; 1976. (14 references)

The growing and in many regions undernourished world population will require a full mobilization of the world's agricultural resources in the future even more than in the past. The fight against harvest-depressing factors is among the most important measures for reaching this objective, and evidence indicates that the use of suitable chemicals will remain an important weapon in this endeavor. New agricultural chemicals will have to satisfy increased standards of performance and environmental safety, which will make pesticide research and development an expensive operation involving high industrial risks. The number of companies willing to accept the challenge has been decreasing in the recent past. The work of companies engaged in pesticide research and development is dependent upon operable regulation requirements imposed by legislators, an adequate system of protection for technical property, and the scrutiny and objectivity of the information media. The agricultural chemistry industry intends to intensify directly or through mediators its dialogue with the public. The risks of uncritical, emotional technophobia should not be underrated. Consciously applied technology is a prerequisite for survival.

76-0850. Abdulla, M.; Dencker, I.; Haglund, G.; Norden, A.; Persson, K.; Von Rosen, G. (Unit Community Care Sci., S-240 10 Dalby, Sweden). **Organochlorine pesticides in food studied by double portion sampling technique.** *Ambio* 3(6): 239-240; 1974. (7 references)

The residue levels of organochlorine pesticides were studied in 113 daily food samples for a group of 67-yr-old pensioners in southern Sweden. The analysis was made using the double portion technique, which comprises making a copy, as exact as possible, of the food and drink consumed during one day. The first series of samples was collected in 1970 and included 36 samples from 11 persons. The second series was collected in 1971 and contained 77 samples from 26 persons. After residue extraction, the analyses were performed by gas chromatography. If necessary the residues were identified by thin layer chromatography. In the first series, DDT and lindane values exceeded detection limits in only 5 and 2 cases, respectively. In 9 cases the total DDT contents were less than 0.02 ppm. Dieldrin could only be detected in 1 case. Aldrin was not detected at all. α-BHC contents were equal to or below the detection limits in all cases. In the second series, almost the same distribution of residue levels was found. In only 8 cases did the total DDT residues exceed 0.03 ppm. Lindane levels were under 0.01 ppm. Except in 1 case the aldrin, dieldrin, and α-BHC values were less than or around detection limits. Chlorinated biphenyls and other chlorinated hydrocarbons could not be detected. None of the residue levels found exceeded the limits set by the World Health Organization. Populations which consume higher quantities of herring and other Baltic Sea fish may be at a greater risk for exposure to high pesticide levels than the average population. In 70% of the 14 cases where the residue limits of lindane exceeded 6.0 μg, considerable amounts of carrots were recorded in the daily portion. Small amounts of lindane are used as a fungicide in carrot seed-dressing. Animal fat is another source of lindane.

76-0851. Kazano, H.; Asakawa, M.; Tomizawa, C. (Natl. Inst. Agric. Sci., Nishigahara, Kita-ku, Tokyo 114, Japan). **Fate of 3,5-xylyl methylcarbamate insecticide (XMC) in a model ecosystem.** *Appl. Entomol. Zool.* 10(2): 108-115; 1975. (11 references)

The fate of 3,5-xylyl methylcarbamate insecticide (XMC, maqbarl) was studied in a model ecosystem consisting of a glass aquarium containing 15 kg of quartz sand and 12 liters of standard reference water. The components were sweet potato leaves, tobacco cutworm larvae, algae, red snail, *Daphnia*, mosquito larvae, and guppy. The study involved the use of 3 tracers: 3,5-dimethyl-^{14}C-, carbonyl-^{14}C-, and *N*-methyl-^{14}C-labeled XMC. Radioactivity in the aquarium water was monitored throughout the 23-day experimental period. XMC was rapidly degraded in water. The peak of radioactivity in aquarium water for 3,5-dimethyl-^{14}C-XMC was comparatively higher than those for carbonyl-^{14}C- and *N*-methyl-^{14}C-XMC. When the aquarium water was extracted with chloroform more than 90% of the radioactivity remained in the aqueous phase. Most of the radioactivity in algae, snails, and fish was not extracted with 66.7% aqueous acetonitrile. The amount of radioactivity extracted with 66.7% aqueous acetonitrile was slightly greater for 3,5-dimethyl-^{14}C-XMC than for carbonyl-^{14}C- and *N*-methyl-^{14}C-XMC. In solvent extracts of water, most of the radioactivity existed as the parent compound. The radioactivity in extracts from living organisms was found mainly in the lower portion of the TLC plate. Ecological magnification was calculated from the concentration of intact XMC in water and organisms. The ecological magnification of XMC was comparatively small compared with those of organochlorine insecticides.

76-0852. Dannals, L. E.; Puhl, R. J.; Kucharczyk, N. (Agric. Chem. Res., Uniroyal Inc., Naugatuck, CT 06770). **Dissipation and degradation of alar in soils under greenhouse conditions.** *Arch. Environ. Contam. Toxicol.* 2(3): 213-221; 1974. (9 references)

The rate of dissipation of alar-^{14}C (succinic acid 2,2-dimethylhydrazide) was studied on four soils under greenhouse conditions. The half-life of alar was 3 to 4 days on all soils. Data derived from experiments with sterilized sandy loam indicated that microbial degradation is the major route for dissipation of alar from soil. Trapping experiments showed that the major degradation product from alar (*N*-methyl-^{14}C) is $^{14}CO_2$, which is liberated in amounts of up to 84% in 14 days. Of the ^{14}C remaining on soil, most is associated with soil organic matter. (Author abstract by permission)

76-0853. Domanski, J. J.; Haire, P. L.; Sheets, T. J. (North Carolina State Univ. Agric. Exp. Stn., Raleigh, NC). **Insecticide residues on 1972 U.S. auction-market tobacco.** *Beitr. Tabakforsch.* 8(1): 39-43; 1975. (13 references)

The results are reported from 1972 samplings of auction-market tobaccos as part of a long-term survey of pesticide residues on tobacco and tobacco products. The moisture content of each sample was determined, and the residue values corrected to 13% moisture content. The results of the study indicate reduction in residue levels of chlorinated hydrocarbon insecticides in tobacco. The average residue levels of DDT and TDE in flue-cured tobacco decreased from 6.1 ppm in 1970 to 0.85 ppm in 1972. A similar drop was noted in the DDT + TDE residues in burley. DDT + TDE residues also declined in fire-cured and air-cured types. In 1972 over 90% of the flue-cured samples were positive for toxaphene. Significant amounts were found in other types also; for example, 50% of the 1972 burley samples had toxaphene concentrations greater than 0.05 ppm. The average endosulfan levels decreased between 1970 and 1972 in flue-cured and burley tobaccos. The average endrin residues were at or near the low detection limit in all samples except fire-cured and dark air-cured tobacco from Tennessee, where these concentrations averaged 0.26 and 0.17 ppm, respectively.

76-0854. Eidt, D. C.; Sundaram, K. M. S. (Maritime Forest Res. Cent., Can. For. Serv., Fredericton, New Brunswick, Canada). **The insecticide fenitrothion in headwaters streams from large-scale forest spraying.** *Can. Entomol.* 107(7): 735-742; 1975. (6 references)

The relation between aerial spray applications of fenitrothion and the incidence of fenitrothion in stream water was studied with emphasis on the effects of spray coverage, wind, rain, and change in stream discharge. For this study the insecticide was applied at the rate of 3 oz/A (210 g/ha) actual fenitrothion in aqueous emulsions from T.B.M. airplanes, flying about 125 ft (38 m) above the tree tops. The spray formulation was 150 parts of 95% technical fenitrothion, 50 parts of emulsifier, Atlox 3409F or Toximul MP8, and 20 parts of a solvent oil, CFTX 107 Aerotex 3470. Water samples were collected from each stream before spraying, and about 1, 4, 10, 24, and 36 hr and 2, 3, and 5 days after spraying. The results of the study showed that, following spraying, fenitrothion was found in all streams, with variations in concentration and duration among streams and in time. At a spray rate of 210 g/ha, if the entire amount settled evenly over a stream whose average depth is 15 cm, the maximum concentration with thorough mixing would be 140 ppb. Usually less than half of the spray emitted by aircraft can be accounted for on spray drop cards in forest clearings. Considering the screening effect of trees, most streams should receive less than 25 ppb and it is not surprising that in this study most observed peaks were lower than 15 ppb, which diminished very rapidly.

76-0855. Horvath, A. L. (Author address not given). **Maximum permissible concentrations of halogenated hydrocarbons in reservoir waters—a review.** *Chem. Ind. (London)* 1: 26-27; 1976. (46 references)

The detailed registry of sources of halogenated hydrocarbons in the environment combined with intensive and widespread monitoring has led to a striking improvement in understanding the contamination of surface waters by these compounds. However, controversies still center about the establishment of standards of acceptable contamination, which are necessary guides for any systems of control. Published data on the maximum permissible concentration of halogenated hydrocarbons in reservoir waters is tabulated. These values were mainly determined in the USSR and published in Russian journals only. Data is given for the following compounds: tetrachloro- and dichloromethane; hexachloro-, trichloro-, and tetrachloroethane; chlorotrifluoropropane; dichlorobutene; hexachloro-, 1,2,4,5-tetrachloro-, trichloro-, dichloro, *o*- and *p*-dichloro, and chlorobenzene; and dichloro- and chlorocyclohexane. A recent Environmental Protection Agency survey reported the presence of chloroform (311 ppb), CCl_4 (3 ppb), bromodichloromethane (116 ppb), dibromochloromethane (100 ppb), bromoform (92 ppb), 1,2-dicuoroethane (6 ppb), and vinyl chloride (6 ppb) in the ground and surface waters of 79 U.S. cities. The significance of these contaminations to human health is as yet undetermined.

76-0856. Herlihy, M.; Quirke, W. (Johnstown Castle Res. Cent., Wexford, Ireland). **The persistence of 2-chloro-6-(trichloromethyl)-pyridine in soil.** *Commun. Soil Sci. Plant Anal.* 6(5): 513-520; 1975. (6 references)

The half-life of 2-chloro-6-(trichloromethyl)pyridine was studied in 3 soils. The soils differed in texture and organic matter content; they were classified as loamy sand, coarse sandy loam, and loam. The soils were incubated at 10 and 20°C. The half-life values for the 3 soils incubated at 20°C were relatively short, which may indicate that slow recovery of nitrifiers may be the operative limiting process where N-Serve is an effective inhibitor at such temperatures. The results at 10°C may be more relevant for temperate climates. In this instance the half-life was 43 days in two of the three soils and was 77 days in the loamy sand. The Q_{10} values based on this study were 5.1, 4.8, and 2.7 for loamy sand, coarse sandy loam, and loam, respectively. In the 2 coarse textured soils the values were outside the range for biologically activated processes. This may indicate that volatilization was relatively more important in these soils.

76-0857. Ubaydullaev, A. Kh. (Uzbek Sci. Res. Inst. Sanit., Hyg. Occup. Dis., Tashkent, USSR). **Sravnitel'naya gigienicheskaya kharakteristika zagryazneniya pestitsidami vozdukha rabochikh mest nekotorykh traktornykh opryskivateley. [Comparative hygienic assessment of the pesticide pollution of the air at the working sites of some tractor sprayers.]** *Gig. Sanit.* 2: 93-94; 1975. (Russian)

Different types of tractor sprayers were compared with respect to the pesticide concentration in the air of the drivers' cabins. The methylsystox, butyphos, and Bi-58 concentrations in the cabin air exceeded the respective maximum allowable concentrations by 3 to 10 times during pesticide application. The lowest pesticide concentrations in the cabin air (about 3 times the maximum allowable concentration) were measured in a tractor sprayer in which the rapid dispersion of the pesticide solution was facilitated by a fan mounted behind the driver's seat.

76-0858. Goncharuk, E. I.; Tsipriyan, V. I.; Stefanskiy, K. S.; Perelygin, V. M. (A. A. Bogomolets Kiev Med. Inst., USSR). **Prognozirovanie stoykosti pestitsidov v vode, pochve i rasteniyakh. [The prognosis of pesticide stability in water, soil, and plants.]** *Gig. Sanit.* 10: 18-22; 1975. (2 references) (Russian)

The persistence of DDT, polychlorocamphene, polychloropinene, lindane, and dilor (beta-dihydroheptachlor) in soil, water, and in foods of vegetable origin was studied in model experiments, using an initial pesticide concentration of 1 mg/kg or 1 mg/l. The rate of degradation was highest in plant material, lower in water, and lowest in soil. In all three media, the persistence decreased in the order DDT, polychloropinene, polychlorocamphene, lindane, and dilor. However, polychlorocamphene appeared to be slightly more stable than polychloropinene in aqueous solutions. The findings

indicate that the persistence of pesticides is a function of the physicochemical properties of the pesticide and of the medium which contains them. Pesticides containing chlorine atoms with melting points between 108-113°C and a volatility of 0.0000001-0.00001 mg/l at 20°C and 760 mm Hg column pressure, and which are insoluble in water and poorly hydrolyzable, can be assumed to be persistent in the environment.

76-0859. Vrochinskiy, K. K.; Panchenko, S. E.; Popovich, N. A. (All-Union Sci. Res. Inst. Hyg. Toxicology of Pesticides, Polymers, and Plastics, Kiev, USSR). **Materialy k obosnovaniyu predel'no dopustimoy kontsentratsii yalana v vode vodoemov. [Data for substantiation of the maximum allowable concentration of molinate in the water.]** *Gig. Sanit.* 10: 104-105; 1975. (3 references) (Russian)

Complex toxicological and hygienic testing of yalan (molinate) was carried out to determine its maximum allowable concentration in water. After application at a rate of 6 kg/ha, molinate was detected in soil for 30 days, and in water on rice fields for 15 days. The organoleptic threshold was determined to be 0.02 mg/l. At a concentration of 0.1 mg/l, molinate did not impair the water quality and did not interfere with biochemical processes in the water. The acute oral LD50 was determined to be 657 mg/kg in rats, and 545 mg/kg in mice. A dose of 13 mg/kg was found to be toxic in chronic experiments. Doses equaling 1/20 and 1/100 of LD50 exerted embryotoxic and gonadotoxic effect. Reduced oxygen consumption, increased 17-ketosteroid level in the urine, eosinopenia, erythrocytopenia, leukopenia, reduced hemoglobin and hematocrit levels, increased pyruvic acid level in the blood, and disturbances in thermal regulation were observed in acute and chronic poisoning tests. The ineffective dose was determined to be 0.65 mg/kg. The maximum allowable concentration of molinate in water is recommended to be set at 0.02 mg/l, with the organoleptic threshold as the limiting factor.

76-0860. Gentile, I. A.; Bonzano, A. (Ist. Patol. Vegetale, Univ. Torino, Turin, Italy). **Sistemicita del fungicida Difolatan nel pomodoro e sua persistenza nella pianta e nel terreno. [Uptake of the fungicide Defolatan in tomato and its persistence in plant and soil.]** *Inf. Fitopatol.* 24(10): 13-18; 1974. (7 references) (Italian)

A study was made concerning the absorption and translocation of the residue from the fungicide Difolatan. Gas-liquid chromatography determinations confirmed that the fungicide can be absorbed and translocated from the roots to the aerial parts of tomato plants. The chemical was taken up from both water suspensions and from treated soils. It was detected in the stems of plants and the foliar petioles, but the highest accumulation occurred in the leaflets. The concentrations of Difolatan in the leaflets of plants treated by soil drench averaged from 10 to 0.4 ppm fresh tissue, 5 and 28 days after treatment, respectively. In clay, sandy, and organic soil, the half-life of the fungicide was 10, 5, and 2 days, respectively. In sterilized soil its degradation rate was markedly reduced.

76-0861. Addison, J. B.; Silk, P. J.; Unger, I. (Dep. Chem., Univ. New Brunswick, Fredericton, New Brunswick, Canada). **The photochemistry of carbamates. V. The photodecomposition of sevin (1-naphthyl-*N*-methyl carbamate) and of phenmec (phenyl-*N*-methyl carbamate).** *Int. J. Environ. Anal. Chem.* 4(2): 135-140; 1975. (12 references)

The photodecomposition of the carbamate insecticide sevin and of phenmec, which is not known to be pesticidal, was studied in aerated and degassed solutions. The solvents used were ethanol, cyclohexane, isopropyl alcohol and *t*-butanol, and the exciting wavelength was + 265 nm. Under all conditions, the major product of sevin was α-naphthol, which was the only product in cyclohexane solution. In polar solvents, phenol and small amounts of naphthalamides and naphthalene were also produced. The production of photo-Fries products was dependent upon solvent polarity, and the nature and position of ring substituents. In the case of phenmec, the products were phenol, 2-hydroxy-*N*-methyl-benzamide, 4-hydroxy-*N*-methyl benzamide, and benzene. Thus, for both sevin and phenmec, photodecomposition proceeded via α- and β-cleavage.

76-0862. Liu, L. C. (Agric. Exp. Stn., Mayaguez Campus, Univ. Puerto Rico, Rio Piedras, Puerto Rico). **Leaching of fluometuron and diuron in a vega alta soil.** *J. Agric. Univ. P. R.* 58(4): 473-482; 1974. (11 references)

A study was made to determine to what extent diuron and fluometuron will leach in the soil from a series of lysimeters under simulated sugarcane field conditions. The highest concentrations of diuron prevailed during the first week of herbicide application. The concentrations of 0.59, 0.31, 0.21, 0.41, and 0.26 ppm were detected from 6, 12, 18, 24, and 36 inch depth levels, respectively. The diuron concentrations at different depths decreased rapidly with the passage of time. The diuron concentrations in the leachate at all depths were not detectable at the end of the 16th week. Approximately 80% of the total diuron leaching loss occurred during the first week. A heavy rain which fell during this period may have contributed to the excessive leaching of this compound. Low concentrations of diuron penetrated to a maximum depth of 36 inches. The highest concentrations of fluometuron were detected in water samples taken 1 week after initial applications. The concentrations were 0.70, 0.37, 0.33, 0.15, and 0.38 for 6, 12, 18, 24, and 36 inch depth levels, respectively. A slower rate of fluometuron concentration decline was noted than for diuron. The herbicide fell below detectable levels at the 20th week. The greatest leaching took place at the second week. On the results of this study it is evident that diuron could pose a contamination problem only within the first 3 weeks of application. As for

fluometuron, the critical period could extend to within 12 weeks of application. The leaching loss of diuron and fluometuron was estimated to be 3.6 and 5.5%, respectively, of the total application.

76-0863. Johnson, J. M.; Dollar, A. M.; Cox, D. C. (Univ. Hawaii Sch. Public Health, Honolulu, HI 96822). **Mirex monitoring in Hawaii. A cooperative venture.** *J. Environ. Health* 38(4): 254-258; 1976. (4 references)

A monitoring program was established in Hawaii to determine whether mirex was escaping from the pineapple fields to the coastal waters, to learn if the pesticide was accumulating in aquatic biota to detectable levels, and to select biota and substrates representing as wide a range as possible of ecological niches and trophic levels. Four coastal areas were selected for monitoring. Mirex was detected in only 5 of 113 estuarine and near-estuarine sediment and biota samples. These samples were of three species of fish taken from the two Maui estuaries. No mirex was detected in sediments, algae, or invertebrates, and none was detected in fish taken from either the Oahu or the Molokai sampling sites. The results of this 1972-1973 monitoring program indicated that mirex usage in Hawaii created no aquatic environmental problem. In 1973 a new program was initiated to determine whether mirex was accumulating in the tissues of terrestrial biota found in association with the pineapple fields and to select vertebrates representing as wide a range as possible of ecological niches and trophic levels. Mirex was detected in 6 of 10 soil samples with the mean pesticide residue for these samples being 3.9 ppb. Of the 20 birds collected, two were negative for detectable mirex. From one additional bird it was not possible to obtain an accurate measurement. Of the 17 birds positive for mirex, 11 were Golden Pacific plovers, 3 ruddy turnstones, 1 a barred dove, and 2 were common mynah birds. No trends in mirex accumulation or excretion could be ascertained. For the mammal testing samples, a total of 3 house mice, 18 Polynesian rats, 23 roof rats, and 22 small Indian mongoose samples were taken. All contained detectable mirex. Analysis of 6 additional mongoose fetuses was also made. A total of 11 marine fish were captured. Three (27%) contained detectable mirex. The mirex residual was 3 ppb in each of these 3 fish. Mirex was detected in appreciable levels in Polynesian rat, roof rat, and small Indian mongoose populations associated with the Maliko pineapple growing area. The data from this study indicates that, for the birds and rodents, the pesticide was assimilated through opportunistic feeding on the mirex baits rather than by a more gradual assimilation through food webs. For the mongooses, the more gradual build-up of detectable mirex may have been the result of bioaccumulation. There was no evidence of mirex build-up in the aquatic organisms sampled. It is suggested that biotoxicity studies are warranted to determine whether the detected tissue levels of mirex have a deleterious effect on wildlife.

76-0864. Stagg, G. V.; Millin, D. J. (Brooke Bond Leibig Res. Develop. Div., Reading, England). **The nutritional and therapeutic value of tea—a review.** *J. Sci. Food Agric.* 26(10): 1439-1459; 1975. (169 references)

Recent information concerning the physiological and therapeutic value of tea is reviewed and rationalized in terms of chemical composition. Among the health hazards which might result from the consumption of tea are those related to pesticide residues on the crop. Although tea is subjected to regular pesticide application in many parts of the world, the commercial product does not contain appreciable quantities of pesticide residues. DDT levels in processed tea averaged 0.1 ppm in one study, with traces of dieldrin and ethion appearing in some samples. Furthermore, a maximum of only 2% of the DDT present was shown to be extracted into hot water. Since maximum permissible levels of all pesticides are set by the FAO/WHO Codex Alimentarius Committee, it is probable that most importing and exporting countries will follow these standards in imposing national food legislations. Small amounts of polycyclic hydrocarbons may also be found in tea samples, but, again, the health hazard from these substances in tea is negligible in the context of the total diet.

76-0865. Halcrow, W.; Mackay, O. W.; Bogan, J. (Clyde River Purif. Bd., Glasgow, Scotland). **PCB levels in Clyde marine sediments and fauna.** *Mar. Pollut. Bull.* 5(9): 134-136; 1974. (11 references)

The lateral and vertical dispersion and distribution of PCBs were studied in the sediments of the Garroch Head area in the Firth of Clyde. The major source of PCB contamination was found to be from accidental seepage into ground waters subsequently entering the sewage disposal system. From sediment analysis it appeared that PCBs were more strongly associated with the heavier organic fraction of the sewage sludge, although there is probably some transport of PCB in the fine particulate fraction, as levels of 26 ng/g were found in sediments 11 km south of the disposal area. Deep contamination of the sediment only occurs close to the center of the disposal area where there is an accumulation of sewage-derived solids on the sea-bed. The data indicates that significant quantities of PCBs have been discharged at Garroch Head for about 20 yr with a marked increase in quantity about 10 yr ago. Analysis of benthic and epibenthic species from the Garroch Head area were confined to molluscs, with three species being used: a carnivore/scavenger, a detritus feeder, and a species feeding on suspended particulate material. A reasonable correlation was found between the sedimentary levels and those found in the molluscan tissue. The high levels found in Chlamys throughout the area studied indicate that PCBs may be carried in a fine particulate organic phase. Transport in such a phase would account for the widespread contamination. With the restrictions imposed by the manufacturers on the use of PCBs and the elimination of other sources in the Clyde catchment area, the levels of PCBs in the Garroch Head area are expected to diminish.

76-0866. Peeper, T. F.; Weber, J. B. (Crop Sci. Dep., North Carolina State Univ., Raleigh, NC 27607). **Vertical**

fluometuron movement in runoff studies in the southern region. *Proc. S. Weed Sci. Soc.* 27: 324-331; 1974.

Studies were conducted to determine whether fluometuron movement through soil profiles, as determined by bioassay methods, was related to the capacity of the soils to adsorb fluometuron from aqueous solutions. The soils included in the study represent a broad spectrum of the physical properties encountered in soils of the Southern Region. The organic matter content varied from 0.7 to 3.7%, while the clay ranged from 12 to 67%. The pH varied from 5.7 to 6.1 and greater than 10 fold variations in cation exchange capacities were measured. Fluometuron was applied at 4.4 kg/ha to plots in Mississippi, N. Carolina, Puerto Rico, and S. Carolina. In the upper 15 cm the relative adsorptivity of the soils from the four locations was: Puerto Rico + Mississippi = S. Carolina + N. Carolina. In the North Carolina soil, the decrease in adsorptivity with depth corresponded to the decrease in organic matter content. None of the soils was able to adsorb fluometuron sufficiently to prevent vertical movement of the herbicide. Although fluometuron dissipation occurred in all soils during the year following application, the herbicide was still detectable in all soils after one year. Following reapplication at the same rate as that of the initial application, the fluometuron content of the upper 15 cm of all soils exceeded the amount present following the initial application.

76-0867. Morriss, A. C.; Nicol, W. M. (Philip Lyle Memorial Res. Lab., Univ. Reading, Reading, Berkshire, England). **Trace constituents in molasses.** *Proc. 1974 Tech. Sess. Cane Sugar Refining Res.*, Agric. Res. Serv., ARS-S-88, 1975, p. 116-124. (1 reference)

The organochlorines are very stable to hydrolysis and will withstand the rigors of temperature and chemical treatment associated with sugar processing. These chemicals include DDT, aldrin, dieldrin, and lindane. These impurities will be excluded from the sugar crystal and become concentrated in the molasses, more specifically, in blackstrap and beet molasses rather than refinery molasses. The selection of a truly representative sample of molasses for analysis is difficult as a bulk sample could consist of fractions from many different origins, resulting in inhomogeneity. The extraction of pesticides from the sample selected may require several steps, as no universal extraction procedure for organochlorine compounds in all materials has as yet been developed. Cleanup procedures fall into two general categories: partitioning, in which the pesticides are partitioned from one solvent into another for which they have a greater affinity than do the interfering substances; and column chromatography. For the analysis a gas chromatograph with an electron capture detector is used and is capable of producing good quantitative results for known pesticides. Due to the nonspecificity of the electron capture detector qualitative identification is not simple and is usually effected by either chemical derivatization or chromatography of the original compounds using a different column. All of the compounds of interest can be detected at a level of 0.002 ppm. To a significant extent the precision is dependent on the level and type of impurity. Organochlorine analysis is both time-consuming and beyond the scope of facilities in the average quality control laboratory. The West German legislative limits on aldrin and dieldrin; chlordane; DDE, DDD, and DDT; endrin; heptachlor and heptachlor epoxide; and BHC and lindane are given for fats, grain and other feedstuffs, as these are the strictest regulations thus far imposed. Enforcement in West Germany is the responsibility of the police, with the backing of university or state facilities. Imported feedstuffs are examined more frequently than nationally produced ones. Controls in Italy, France, and the United States are briefly considered.

76-0868. Edwards, C. A. (Rothamsted Exp. Station, Harpenden, Hertfordshire, England). **Factors that affect the persistence of pesticides in plants and soils.** *Pure Appl. Chem.* 42(1-2): 39-55; 1976. (72 references)

Some of the factors influencing the persistence of pesticides are applicable to both plants and soils. Among these factors are the characteristics of the pesticide itself, including its stability, volatility, solubility, formulation, and method and site of application. Other factors include environmental determinants, including temperature, precipitation and humidity, and air movement. The other factors affecting pesticide persistence are the properties of the plant or soil. Characteristics affecting the persistence of pesticides in plants include the plant species involved, the nature of the harvest crop, the structure of the cuticle, the stage and rate of growth, and the general condition of the plant. Corresponding soil characteristics are the soil type and structure, its organic matter and clay contents, its acidity or alkalinity, its mineral ion content and degree of aggregation, and its microbial population. Of these factors, the most important seem to be related to the chemical stability and physical properties of the pesticide. Of the plant characteristics, the species and rate of growth are the most important factors, while the most important soil characteristics are the organic matter and clay contents and the soil microorganisms present.

76-0869. Junge, C. E. (Max-Planck-Inst. Chem., Mainz, Germany). **Transport mechanisms for pesticides in the atmosphere.** *Pure Appl. Chem.* 42(1-2): 95-104; 1976. (16 references)

Studies of the fate of pesticides in the local, regional, and global environments have demonstrated that these substances have reached the biosphere ranging from pole to pole, and that, at least for DDT, most of the material is transported through the atmosphere into the oceans. Thus, transport processes by and through the atmosphere are of basic importance for understanding of regional and global distribution problems. The transport and distribution of trace substances in and by the atmosphere are determined by the chemical characteristics of the substance itself and by the meteorological transport, mixing,

and other processes in the atmosphere. Global variability of constituents within the troposphere is strongly correlated to tropospheric residence time. If this is longer than about half a year, the constituent shows a fairly uniform distribution, so that the details of the atmospheric transport are unimportant. The residence time of a trace constituent is longer with a stable and inert gas and shorter with reactive gases and aerosols. In general, the vapor pressures and solubilities of pesticides and PCBs are very low, and available evidence points to residence times similar to those of aerosols, i.e., about 1 wk. If this is the case, the transport processes of advection and large-scale mixing, together with the various removal mechanisms for aerosols, such as rainout, washout, and sedimentation, will become important. This will result in considerable regional differences in concentration. Three main large-scale transport processes will be operative: west-east transport in the west wind circulation belt primarily between lat. 30 and lat. 70; transport in the trade wind belt between about 20°N and 20°S; and the fact that there is very little exchange of short-lived constituents between hemispheres.

76-0870. Lichtenstein, E. P. (Dep. Entomol., Russell Lab., Univ. Wisconsin, Madison, WI 53706). **Transport mechanism in soil: metabolism and movement of insecticides from soils into water and crop plants.** *Pure Appl. Chem.* 42(1-2): 113-118; 1976. (8 references)

The persistence, movement, and metabolism of insecticides in soils are affected by various environmental conditions. Field data indicated that after granular band application, phorate moved in both horizontal and vertical directions, and that phorate sulfone was the major metabolite produced. The metabolism and persistence of this compound was also affected by its mode of application. Utilizing a soil-plant-water ecosystem, it was shown that the percolation of water through the system did not affect the movement of (^{14}C)phorate through loam soils, but that it did affect movement through soils with lesser or no sorptive capacity. Water percolated through agricultural soils contained phorate sulfoxide and phorate sulfone, while corn greens grown in the ecosystem also contained phoratoxon sulfoxide and phoratoxon sulfone. With (^{14}C)dyfonate, the insecticide did not move to an appreciable extent through an agricultural loam soil and its transport with water through soils was, to a large extent, a function of the soil type. Detergents increased the persistence of parathion in soil and indirectly increased the amount of parathion in percolated water. The presence of salts prevented the appearance of aldrin residues in percolated water and reduced the amount of parathion residues. The movement of insecticides from soils into plants was dependent on the energy supply systems of the root cells, soil nutrients, and the soil insecticide concentrations.

76-0871. Medved, L. I. (All-Union Sci.-Res. Inst. Hygiene Toxicol. Pestic. Polymers Plastics, Kiev, USSR). **Circulation of pesticides in the biosphere.** *Pure Appl. Chem.* 42(1-2): 119-128; 1976. (31 references)

In the USSR, there are over 500 laboratories established at National Sanitary and Epidemiology Stations for systematically estimating pesticide residues in plant and animal products, water and drinking water, atmospheric air, and air in working areas. Of particular importance are records indicating intervals between pesticide applications and crop harvesting. This data aids in the prevention of intolerable pesticide residues in food and in determination of the best time for work in fields and gardens after pesticide application. Sanitary standards for distance between target and populated areas have also been established and the capacity of pesticide storage in food chains has been determined. The primary pesticide cumulator is the soil, from which chemicals are transferred through root systems into plants. Heptachlor, which is found in levels of thousands of mg in the soil, is found in carrots at levels of 1 mg/kg. Secondary pollution is also a risk since pesticides migrate from the soil to underground water, natural water, and the atmospheric air. Pesticide concentrations of thousandths of mg/liter in water, hundredths and tenths mg/kg in zoophytoplankton, and 5 mg/kg in fish have been detected, while levels of 1-2 mg/kg have been detected in hares and 5-8 mg/kg have been detected in wolves. Only a portion of the pesticide applied reaches the target area; the rest is carried by the wind to higher atmospheric layers and precipitated. To prevent health hazards, it is necessary to preclude the use of particularly stable and persistent pesticide preparations.

76-0872. Bagge, P. (Dep. Hydrobiol., Univ. Jyvaskyla, Jyvaskyla, Finland). **Pesticide residues in some Baltic animals—a review of selected literature.** *Pure Appl. Chem.* 42(1-2): 129-137; 1976. (25 references)

During the past few years, considerable efforts have been devoted to tracing halogenated hydrocarbons, particularly PCB and DDT, and mercury in Baltic animals. In general, these studies have indicated that the concentrations of these compounds in Baltic animals are higher than those in the corresponding species on the west coast of Sweden and in Norwegian waters. The highest DDT residues appear to occur in the animals of the southern Baltic and the Sound (Oresund). The highest methylmercury levels in Baltic fish occur in individuals found in certain coastal areas, usually polluted by pulp mill wastes, while fish caught in the sea appear to be less contaminated. Especially high concentrations of pesticides have been found in the fish-eating birds and mammals of the Baltic, viz., in animals representing the top levels of the food chains. So far, no fatal poisoning of fish or waterfowl due to high pesticide concentrations has been observed in the Baltic area. The situation is worse among white-tailed eagles and some other raptorial birds whose populations have almost totally disappeared in many coastal regions, probably owing partially to the synergetic effects of all accumulated contaminants.

76-0873. Rosival, L.; Szokolay, A. (Res. Inst. Hygiene, Bratislava, Czechoslovakia). **Ecochemistry of BHC in Czechoslovakia.** *Pure Appl. Chem.* 42(1-2): 167-176; 1976. (16 references)

Thin-layer and gas chromatography were used to determine the DDT, lindane, and BHC residue levels in samples of soil, surface water, plant and animal foodstuffs, human milk, human fat, and human uterine contents. The samples were obtained from three regions of Slovakia, one of them representing a lowland type geographical region, another a mountainous region, and the third a mixed region with lowlands-like agriculture. Lindane and the α-, β-, and γ-isomers of BHC were found in all samples. In the soil, potato, water, and human food samples, the γ-isomer of BHC was more prevalent than the β-isomer, whereas in the poultry feed, egg, butter, and human milk samples, the β-isomer predominated. In the soil, human food, potato, egg, and chicken feed samples, the total DDT content was higher than the BHC content, whereas the reverse was true in the case of the water, butter, and human milk samples. The BHC β-isomer levels were higher in human milk fat than in cow milk fat. Samples of human uterine contents showed a predominance of total DDT over total BHC, a predominance of DDT over DDE, and higher concentrations of total DDT and BHC in the lowland region samples as compared with the submountainous region samples. The overall DDT and BHC content was also higher in human fat samples from areas of high pesticide use than in fat samples from the submountainous regions. DDT and BHC residues were lower in the fat of persons aged greater than 45 yr than in those aged less than 45 yr. The estimated DDT and BHC burden of the human organism in Czechoslovakia was 0.0037 and 0.0042 mg/person/day, respectively, while the daily intake of these substances in the total diet was 0.099 and 0.053 mg/day, respectively. It is suggested that the ADI for lindane be lowered.

76-0874. Dunn, C. L. (Hercules Inc., Wilmington, DE). **The value of worldwide pesticide residue monitoring systems.** *Pure Appl. Chem.* 42(1-2): 177-188; 1976. (8 references)

The objectives of pesticide monitoring programs are normally related to assuring safety to man and his environment. Analysis is required to identify and measure residues. Judgments of environmental consequences resulting from the use of toxic materials must be based in part on sound knowledge of the amounts and nature of residues in environmental compartments. Models of varying detail are a means of achieving this knowledge and they can assist in making judgements concerning any needed controls. Monitoring is an essential part of constructing models and determining the success of measures intended to control contamination or pollution. Monitoring programs can be classified according to their intended functions: modeling, scouting, surveillance, and isolated verification. Each monitoring program should be appraised according to the usefulness of the information obtained and the cost of obtaining it. The assignment of costs in terms of resource allocation should include an estimate of alternative productivity if the resources were utilized in other endeavors, while the benefits of the program should be accounted for and the value expressed as benefit/cost ratio. Because benefit estimates involve social, aesthetic, and economic desires and achievements, disputes will arise concerning the validity of value determinations, and decisions will not be made exclusively on a scientific basis. The ultimate value of monitoring systems may thus be in providing a better foundation on which to base both scientific estimates and political decisions.

76-0875. Clausen, J.; Berg, O. (Inst. Hygiene, Social, Preventive Med. Environ. Sci., Odense Univ., Odense, Denmark). **The content of polychlorinated hydrocarbons in arctic ecosystems.** *Pure Appl. Chem.* 42(1-2): 223-232; 1976. (24 references)

Adipose tissues from two common porpoises (*Phocaena phocaena*), five bearded seals (*Erignathus barbatus*), five ringed seals (*Phoca hispida*), five hooded seals (*Cystophora cristata*), two arctic foxes (*Alopex lagopus*), one polar bear (*Ursus maritimus*), and one sheep (*Ovis aries*) shot on the west coast of Greenland were analyzed by electron capture gas chromatography for polychlorinated hydrocarbons. Studies were also made on adipose tissue from king eider (*Somateria spectabilis*), common eider (*Somateria mollissima*), harlequin duck (*Histrionicus histrionicus*), long tailed duck (*Glangula hyemalis*), purple sandpiper (*Calidris maritima*), Brunnich's guillemot (*Uria lomvia*), cormorant (*Phalocrocorax carbo*), ptarmigan (*Lagopus mutus*), and raven (*Corvus corax*), as well as adipose tissue from six female Greenlanders. Among the birds, raw *p,p'*-DDE concentrations ranged from 0.8 ppm (eider duck) to 13.9 ppm (raven), while PCB concentrations ranged from 2.0 ppm (eider duck) to 37.1 ppm (raven); the *p,p'*-DDE and PCB concentrations were significantly correlated. *p,p'*-DDT and *p,p'*-DDD were not traced, and lindane was found in trace amounts in 1/3 of the birds. Among the mammals, lindane concentrations ranged from 0.003 ppm (hooded seal) to 0.053 ppm (bearded seal), heptachlor was found in concentrations of 0.001 ppm (ringed seal) to 0.039 ppm (bearded seal), aldrin ranged from 0.028 ppm (hooded seal) to 3.06 ppm (polar bear), heptachlor epoxide was found in concentrations of 0.026 ppm (ringed seal) to 0.49 ppm (polar bear), raw *p,p'*-DDE ranged from 0.14 ppm (arctic fox) to 1.25 ppm (polar bear), and PCB ranged from 0.9 ppm (ringed seal) to 21.0 ppm (polar bear). In the human samples, PCB ranged from 0.25-5.58 ppm, *p,p'*-DDE ranged from 0.04-0.52 ppm, and the other compounds were found only in trace amounts.

76-0876. Smith, A. E. (Agric. Canada, Regina Res. Stn., Regina, Saskatchewan, Canada). **Degradation of trichloroacetic acid in Saskatchewan soils.** *Soil Biol. Biochem.* 6(3): 201-202; 1974. (3 references)

The persistence of ^{14}C-TCA at rates equivalent to 4.4 kg/ha was studied in 3 soil types at different moisture contents. The disappearance of the ^{14}C-TCA from all 3 soil types at the higher moisture regime showed a similar trend. Little breakdown occurred at the first few weeks of incubation, but an increase in the rate of degradation occurred later. Loss of the chemical was most rapid in the high organic silty clay, with almost complete breakdown after 3 weeks at the higher moisture regimes. Degradation was slowed in the sandy loam and heavy clay. In all cases, at moistures close to the wilting point over 50% of the applied chemical could still be recovered after 7 weeks. Thus, these results confirm conclusions of earlier studies. It may be concluded also that TCA carry-over from one growing season to the next in field soils of the type studied should not be a problem.

76-0877. LaFleur, K. S. (Dep. Agron. Soils, Clemson Univ., Clemson, SC 29631). **Prometryne desorption and movement in soil columns.** *Soil Sci.* 121(1): 9-15; 1976. (33 references)

The desorption and movement of prometryne in selected South Carolina soils is considered. Prometryne is an herbicide used to restrict growth of broadleaf weeds and grasses in corn and cotton cropland. Soil was treated with 1 to 100 μmol/kg prometryne from 0.001 *M* or 0.01 *M* ethanol solution. The solvent was allowed to evaporate at least 24 hr. The treated soil was shaken with water at room temperature for 2 hr. Desorption was rectilinear for the prometryne/soil range 1-100 μmol/kg. *K*b (desorption constant) values for 1/1 soil/water systems ranged from 0.86 for Lakeland s (0.22% organic matter) to 12 for Okenee sl (5.16% organic matter). Desorption of prometryne from model soils gave a *K*b = 0.25 for sand; *K*b = 0.76 for sand containing 20% kaolin, and a *K*b = 99 for sand containing 5% peat. These findings illustrate the effect of diverse additives. Prometryne movement in 1 m soil columns wet with 1 pore volume of water varied with soil organic matter and texture. 1/*Zpd* values (characterizing values based on prometryne distribution within the column at equilibrium) for 10 μmol/m prometryne treatment ranged from 0.64 for Lakeland s to 4.6 to Okenee sl. *K*b and 1/*Zpd* values, while numerically different, are highly correlated. This suggests that prometryne movement in soil columns can be predicted from desorption data. It is suggested that an extension of these findings to other pesticides may be possible. Crude predictions of prometryne movement in field plots from adjusted *K*b values may be possible if suitable adjustments for degradation losses can be made.

76-0878. Choi, J.; Aomine, S. (Fac. Agric., Kyushu Univ., Fukuoka, Japan). **Adsorption of pentachlorophenol by soils.** *Soil Sci. Plant Nutr. (Tokyo)* 20(2): 135-144; 1974. (14 references)

Studies were made of the effect of the pH, clay mineral species, and organic matter in soils on the adsorption of PCP by soil. Thirteen soil samples of various clay mineral species and organic matter contents were used in this investigation. Five grams of air-dried soil samples and 25 ml of a PCP solution were combined with deionized water so that the total water was 50 ml. The concentrations of PCP studied ranged from 12.5 to 500 ppm. The results of the experiment indicated that apparent adsorption occurs to the greatest extent on the strong acid soil system compared to the moderate acid soil system, regardless of the species of clay mineral and organic matter content. There is no adsorption on the slightly acid or neutral soil systems. The adsorption involves adsorption of molecules and/or anions and precipitation of molecules in the micell and the external liquid phase. The magnitude of adsorption occurs in the decreasing order of humus-allophanic, allophanic, montmorillonitic, and halloysitic soils. The major factor governing the magnitude of apparent adsorption is pH.

76-0879. Mansue, L. J.; Anderson, P. W. (Author address not given). **Effects of land use and retention practices on sediment yields in the Stony Brook basin, New Jersey.** *Sedimentation in small drainage basins. Geological Survey Water-Supply Paper* 1978-L, U.S. Govt. Printing Office, 1974, p. 4-L33. (20 references)

In the course of evaluating the water resources of the country, stream sediment characteristics were investigated, including random collections and analyses for 10 chlorinated hydrocarbon pesticides. The area under study was Stony Brook, at Princeton, N.J., with some collections at the Carnegie Lake. The water-phase data indicated the presence of DDT and its metabolites, DDD and DDE, and some dieldrin and lindane. Concentrations were slightly higher in samples collected in the spring than in the fall, perhaps indicative of an input from agricultural usage. The bed-material data indicated only the presence of DDT and metabolites. Spring collection data showed concentrations at one site increasing in the amount of DDT-type compounds, in relation to fall samples, while the concentrations of these chemicals decreased at the other 3 testing sites. It is suggested that this finding may be related to sampling techniques or bed movement. In samples taken from Carnegie Lake, the average concentration of DDD and DDT was 1000 times the levels observed in the water phase. These high concentrations of DDD may be due to the degradation of DDT which entered the water medium at some previous time but ended up in sediments as a persistent residue.

76-0880. Vind, H. P.; Muraoka, J. S.; Mathews, C. W. (Naval Civil Eng. Lab., Port Hueneme, CA 93043). **Biodeterioration of navy insecticides in the ocean.** *Natl. Tech. Inform. Serv.*, AD-773 101, 1973, 14 p. (7 references)

Tests of the persistency and stability of chlorinated insecticides (aldrin, bulan, chlordane, DDT and its metabolites, endrin, heptachlor, lindane, Kepone, HCB, and methoxychlor) in sea water were completed in June 1973. Insecticide-impregnated wood was preleached either in the ocean or in hot sea water and then exposed in

aquaria to attack by wood-borers of the species *Limnoria tripunctata*. The decline in toxicity of the wood, caused by preleaching it, was greater in the ocean than in hot sea water. The decline was greater for wood impregnated with the most fat soluble insecticide than with the least fat-soluble ones. In the stability tests, the insecticides were deposited on diatomaceous earth and cultured with marine microorganisms. None of the insecticides were degraded appreciably in one year. It is unlikely that biodegradation of insecticide caused the decline in the toxicity of the wood. It was postulated that the water-insoluble but fat-soluble insecticides were transported from the wood and into the ocean by heat-sensitive microorganisms having lipophilic cell membranes. The concept predicts that insecticides slightly less fat-soluble than DDT will not enter the ocean food chain as readily as DDT. They would not be as hazardous as DDT and yet might be just as toxic and persistent. (Author abstract by permission)

76-0881. Schatmeyer, J. F.; Urone, P. (Dep. Environ. Eng., Univ. Florida, Gainesville, FL). **A tracer study of meteorological influence on the dispersion of ground-applied insecticide aerosols.** *Natl. Tech. Inform. Serv.*, AD-773 653, 1973, 286 p. (81 references)

Dispersion of insecticide aerosols was studied at a residential test site under a variety of nocturnal conditions. Five programmed sequential aerosol samplers were used to capture fluorescent particle-traced aerosol droplets. Measurements were conducted at ground and elevated locations. Simultaneous and coincident biological measurements were performed with live caged mosquitos in order to assess standard rate ULV applications of malathion insecticide. Meteorological measurements included vertical temperature and wind structures, atmospheric turbulence, net radiation, and reference wet and dry bulb temperatures. A total of 21 test runs were conducted on 6 separate evenings at a 500 × 650 ft test site in North central Florida during August and September, 1972. (Author abstract by permission)

76-0882. Thomas, J. F.; Pauls, C. F. (USAF Environ. Health Lab., Kelly AFB, TX 78241). **Survey of wastewater discharge — Elmendorf AFB, Alaska.** *Natl. Tech. Inform. Serv.*, AD-782 480, 1974, 60 p. (13 references)

A wastewater survey was completed at Elmendorf Air Force Base, Alaska from the 16th to the 22nd of June, 1973. Wastewater sources, discharge routes, and treatment processes were evaluated during the survey. Insecticides and herbicides used on the base include the following: malathion, diazinon, and baygon (propoxur) are used in kitchens, housing, bakeries, officers clubs, etc., as appropriate. Herbicides include 2,4-D, and Telvar. Fifty feet along roadsides are treated with 1% 2,4-D for dandelion control. Telvar is used to control vegetative growth around signs and fire hydrants, and is applied at the rate of one teaspoon per acre. The fungicide Kromad was applied three times on all greens of the golf course. Calo-Gran was used for snow mold control and contains mercurous chloride. From the information gathered in this study, recommendations were made for handling of wastes from specified operations. Recommendations were also made regarding fungicides used on the golf course. A sampling and analysis program was outlined so that compliance with applicable water quality standards could be demonstrated.

76-0883. Roan, C. C. (USA Environ. Hyg. Agency, Aberdeen Proving Ground, MD 21010). **DA Pesticide monitoring program. Evaluation of data from environmental samples collected prior to 1 Jan 74, Part I, soil, sediment, water, 1 Sep 74.** *Natl. Tech. Inform. Serv.*, AD-A003 228, 1974, 11 p.

Analyses for pesticide residues were conducted on 389 environmental samples comprised of soil, water, and sediment. Only 3 pesticides were detected in the 162 surface water samples collected from 37 installations. These three were dieldrin, aldrin, and endrin. In only one instance were all three detected in the surface water samples taken from a single installation. Only 5% of the installations were positive and only about 3% of the samples were positive. For samples of sediment, the average ppm for DDT was .029; for DDE, .018; for DDD, .044; for dieldrin, .005; and for chlordane, .010. One hundred and fifty-one soil samples from 72 Army installations were also analyzed yielding average ppm for DDT, .99; DDE, .42; DDD, .07; dieldrin, .06; aldrin, .0002; chlordane, .10; and lindane, .0005. From the results of this study it is suggested that the principle of scheduled sampling of surface waters several times during any 12 month period should be carefully reexamined. The surface water environment is exceptionally dynamic. Its total composition may change both qualitatively and quantitatively within a number of hours. In the sediment samples, the ratio of DDT to its predictable metabolites was higher than would generally be expected. In evaluating the data collected, it is indicated that sediment samples be stratified so that they may be related to the local environment from which they were collected. Sediments from streams and impounded bodies of water were inherently different. The high and low flow rates of streams or rivers will likewise produce different situations. In soil samples, the fact that persistent pesticides are found in higher concentrations in soil from Army installations than is true for agricultural croplands is viewed as significant. It is concluded that the Army's use of pesticides within the continental United States has not, in general, contributed significantly to widespread unwarranted environmental insults.

76-0884. Roan, C. C. (U.S. Army Environ. Hyg. Agency, Aberdeen Proving Ground, MD 21010). **Entomological special study No. 44-004-74/75. Revised Department of the Army Pesticide Monitoring Program, 1 April 1975.** *Natl. Tech. Inform. Serv.*, AD-A004 030, 1975, 38 p.

A program was established to evaluate the pesticide residues in samples of bottom sediment, soil, fish,

and birds which should be representative of the universe from which they were collected. It is essential that care be exercised in collection procedures. The program is designed to routinely analyze environmental samples from only a few representative large installations. The data thus generated should be helpful in predicting pesticide levels in similar components at other installations where similar pest control programs are conducted. Multiple sampling of the stratified soil component is required in the initial phases of the program to permit estimates of the qualitative and quantitative distribution of pesticides. Soil samples are collected using a standard bulb planter, details for which are provided. Sediment samples are to be collected using a USBMH 60 Bed Material Sampler. Fish samples should be collected from the same site from which the sediment samples were collected. A minimum of 5 fish with a total weight of at least 1 kg must be submitted from each of two families, one a surface and the other a bottom feeding fish. The fish should be collected with the aid of a gill net or seines. One of the goals of this revised environmental sampling program is to provide data supporting pesticide and pest management program changes in the Army.

76-0885. Evans, J. O.; Duseja, D. R. (Dep. Plant Sci., Utah State Univ., Logan, UT). **Herbicide contamination of surface runoff waters.** *Natl. Tech. Inform. Serv.*, PB-222 283, 1973, 99 p. (62 references)

Field and laboratory studies of the movement of herbicides were conducted to determine their potential as contaminants in irrigation return flow. Special emphasis was given to the use of herbicides for vegetation control along ditches, canals, and watersheds where high dosages are required to control the excessive growth of grasses and broadleaved weeds. The following herbicides have been studied: substituted urea (diuron), triazines (summitol and atrazine), phenoxyacetic acid (2,4-D and 2,4,5-T), and a substituted pyridine (picloram). The greatest tendency for transport of herbicides in water coming in contact with soils occurs during the initial storms following spray application. If the intensity of the initial precipitation is not sufficient to cause movement across the soil, the danger of herbicide movement is essentially eliminated. The highest concentrations (ppm) of herbicide observed in surface waters were 1.8, 0.5, 4.2, 1.2, and 2.7 for diuron, summitol, 2,4-D, 2,4,5-T, and picloram, respectively. These levels were observed immediately below treated areas receiving the higher recommended dosages of the herbicides. All herbicide concentrations dropped below the limit of detection within a few hundred meters below the sprayed areas. Presumably, soil filtration, adsorption, and dilution are primarily responsible for the loss of herbicides from water. (Author abstract by permission)

76-0886. Norton, J. L. (Oklahoma Water Resour. Res. Inst., Stillwater, OK). **The identification and measurement of chlorinated hydrocarbon pesticides accumulated from urban runoff.** *Natl. Tech. Inform. Serv.*, PB-226 307, 1973, 38 p. (10 references)

A total of 198 samples of runoff and Arkansas River water were collected in the metropolitan area of Tulsa, Oklahoma and analyzed for chlorinated hydrocarbon pesticides from March, 1970 through June, 1972. Sampling at 15 different sites was conducted in three phases: (1) Arkansas River water above and below the metropolitan area, (2) storm drainage basins at maintenance flow, and (3) storm-water runoff. Pesticides identified entering the river from drainage basin outfalls at some time during the project include lindane, heptachlor, heptachlor epoxide, aldrin, and dieldrin. A supplementary investigation of heavy metals in storm-water runoff identified lead and chromium entering the Arkansas River from drainage basin outfalls. (Author abstract by permission)

76-0887. Environ. Protect. Ag. (Washington, DC). **Processes, procedures, and methods to control pollution resulting from silvicultural activities.** *Natl. Tech. Inform. Serv.*, PB-226 658, 1973, 102 p.

Pesticides are among the principal water pollutants from the nearly 203 million hectares (500 million acres) of forest managed primarily for the production of timber in the United States. Sediment is the greatest single cause of water quality degradation. It also acts as a carrier of such pollutants as pesticides. Insecticides, fungicides, herbicides, silvicides, and rodenticides used to control silvicultural pests may be directly deposited in surface water courses by careless application or be transported there in surface or subsurface runoff. It is noted that the great majority of pesticides used in silviculture are not materials native to the forest environment. For pesticide control, knowledge is essential of persistence of the pesticide at the point of use, its rates of degradation, its modes of degradation, its biological and chemical metabolites, and the mechanisms of transport through the environment to nontarget species. The use of pesticides in silviculture is inextricably related to ecosystem stability in the forest system. The control of pesticide pollution in the aquatic environment is therefore intimately related to controls imposed for protection of the forest ecosystem. The effective control of sediment discharge will constitute a high level of effective control as well as of pesticide and nutrient emissions from forest lands. The following approaches have been used in an attempt to control pesticide pollution: rigorous management of aerial application to protect nontarget areas and maximize effectiveness on target species; application from the ground on specific targets; scheduling of applications for maximum dispersal to nontarget areas; avoidance of highly persistent, bioaccumulated chemicals; minimum use of prophylactic applications; increased use of cultural and mechanical methods to control pests and weeds; and dependence on natural prey-predator relationships.

76-0888. Phillips, J. H.; Haderlie, E. E.; Lee, W. L. (Hopkins Mar. Stn., Stanford Univ., Pacific Grove, CA

93950). **An analysis of the dynamics of DDT and its derivatives, DDD and DDE, in marine sediments.** *Natl. Tech. Inform. Serv.*, PB-238 511, 1974, 106 p.

The concentrations of three chlorinated hydrocarbons DDT, DDD, and DDE, were measured in sediments at 57 stations in Monterey Bay on the Central California coast during 1970 and 1971. Mean concentration (ppb) was DDT, 3.1; DDD, 2.3; and DDE, 5.4. Maximum concentrations were DDT, 19.3; DDD, 8.7; and DDE, 20.5 ppb. The distribution of the three compounds within South Monterey Bay was charted. During 1973, nineteen of the original stations, representing locations that were low, intermediate, and high concentrations in the original survey, were resampled. The mean concentrations approximately three years later were DDT, 15.5; DDD, 2.3; and DDE, 5.4 ppb with maximum levels of DDT, 83.1; DDD, 11.4; and DDE, 17.5 ppb. Concentrations in South Monterey Bay were essentially the same. Two approaches were developed to the estimation of annual system rates for input, I, output, O, decay, D, and internal translocation, T_I and T_O, expressed as decimal fractions of the existing concentration. The approaches to these estimates are dependent upon variability in net rates of change at the various stations and an approach to evaluation of the standard deviation of the estimated rates relative to distributions of net rates with minimal variance is presented. Laboratory assays were developed to determine the relative rate of decomposition in sediment placed under conditions selective for various physiologically different kinds of microorganisms. Decay of the three chlorinated hydrocarbons under aerobic conditions without additional nutrients was greater than decay under anaerobic conditions. Nitrate as an accessory electron acceptor increased the rate of decomposition under anaerobic conditions. Degradation products formed from the parent compounds included water soluble intermediates as well as carbon dioxide. (Author abstract by permission)

76-0889. Dappen, G. (Nebraska Wesleyan Univ., Lincoln, NB). **Pesticide analysis from urban storm runoff.** *Natl. Tech. Inform. Serv.*, PB-238 593, 1974, 44 p.

Urban storm runoff was analyzed for pesticide content. Hexachlorobenzene (HCB), pentachloronitrobenzene (PCNB), heptachlor, heptachlor epoxide, lindane, and dacthal were identified and selected for monitoring. Lindane and dacthal were primarily used in the determination of the profile and runoff patterns during a rainstorm. Although pesticide concentrations were higher near the end of the runoff period, the largest amount of pesticide flushing from an area occurred during the maximum runoff period. Major rains, rains that followed periods of wet weather, or rains of longer duration produced higher quantities of pesticides running off than moderate rains of high intensity following dry periods. Much variation in the amount of pesticide running off was encountered. (Author abstract by permission)

76-0890. Lavy, T. L. (Water Resources Res. Inst., Nebraska Univ., Lincoln, NB). **Mobility and deactivation of herbicides in soil-water systems.** *Natl. Tech. Inform. Serv.*, PB-238 632, 1974, 32 p. (13 references)

The objectives of this project were to investigate methods which could be used to deactivate or remove herbicides present in aqueous system and to measure the mobility of four herbicides (alachlor, atrazine, butylate, and picloram) in three Nebraska soil profiles. Charcoal and exchange resins were effective in removing as much as 99% of the 1.2 ppmw herbicide present in an aqueous solution. In a degradation study, the presence of soil colloids and other soil constitutents markedly enhanced the breakdown rate of atrazine, alachlor, and 2,4-D in a 24-week storage study. A cucumber bioassay was used to detect herbicides remaining in the solution while a soil bioassay using soybeans and millet was effective in monitoring for herbicides in the soil. Studies to determine if degradation of herbicides occurs in samples of groundwater incubated at 10 and 25°C for periods up to 15 months showed picloram was more stable than atrazine or alachlor. Considerably less degradation occurred at the lower temperature (which is comparable to field conditions). A field leaching study showed that mobility becomes more rapid as the herbicide moves farther from the surface. Picloram was more mobile than atrazine or butylate under irrigated sandy soils. (Author abstract by permission)

76-0891. Gillett, J. W.; Hill, J., IV; Jarvinen, A. W.; Schoor, W. P. (Natl. Ecol. Res. Lab., Environ. Protect. Agency, Corvallis, OR 97330). **A conceptual model for the movement of pesticides through the environment: a contribution of the EPA alternative chemicals program.** *Natl. Tech. Inform. Serv.*, PB-238 653, 1974, 89 p.

This report presents a conceptual model of the movement and disposition of pesticides in the environment. A multi-media model is built up from simple modules representing basic processes and components of air, soil, and water. More specific models are exposited for the atmospheric/terrestrial, freshwater aquatic, and estuaring/marine environments. Through iterative operations of expansion and systematic reduction of the components and processes these models of segments of the environment can be joined to provide a holistic view of the disposition of a chemical and its attendant effects. Ultimately systems analysis and mathematical simulation techniques can be employed to evaluate the fate of a specific chemical in a particular environment. The conceptual model is thus a first step in organizing facts, assumptions, and hypotheses into a graphic and logical arm capable of exploitation in further experimentation of pesticide disposition and effects. While rejecting formulation of a model with global validity, the authors emphasize the commonalities of the basic processes and components in the various environments. Thus, a multi-media approach to disposition studies is made explicit even in the absence of a single all-media global model. (Author abstract by permission)

76-0892. Reimold, R. J.; Adams, P. C.; Durant, C. J. (Mar. Inst., Univ. Georgia, Sapelo Island, GA 31327).

Effects of toxaphene contamination on estuarine ecology. *Natl. Tech. Inform. Serv.*, COM-74-10408, 1973, 106 p.

The purpose of the research was to quantify potential effects of toxaphene effluent on the estuarine fauna and flora and monitor quantitative changes in the ecosystem that might be associated with a toxaphene pollution abatement program initiated during the study period. The major study area was a salt marsh watershed adjacent to a toxaphene production plant in coastal Georgia. Toxaphene concentrations in the manufacturing plant effluent decreased over one order of magnitude during the study period. Significant increase in diversity was concurrent with the simultaneous decrease in apparent toxaphene content of plant effluent. Toxaphene content in organisms collected in the toxaphene contaminated marsh area also decreased significantly during the three-year period. The toxaphene content of the plant effluent decreased simultaneously with the toxaphene content of fauna, flora, and sediments. Concurrent with this was a significant increase in species diversity. The quantitative results indicate a significant improvement in the health and diversity of the ecosystem. (Author abstract by permission)

76-0893. Reimold, R. J. (Georgia Mar. Sci. Cent., Savannah, GA). **Toxaphene interactions in estuarine ecosystems.** *Natl. Tech. Inform. Serv.*, COM-75-10104, 1974, 88 p. (6 references)

During 1973-1974, the toxaphene concentration in effluent from the Brunswick manufacturing plant continued to decrease from around 30 ppb to near 6 ppb. Concurrent with this was an increase in the species diversity of organisms in waters receiving the effluent. During 1973-1974 the diversity index, H Bar, was 1.9977 in the Duplin Estuary (considered to be undisturbed and free from any toxaphene contamination) contrasted with a higher index of 2.2577 in Terry Creek (which receives effluent containing toxaphene). Experiments to follow the movement of toxaphene from the substrate into the salt marsh cordgrass, *Spartina alterniflora*, using ^{36}Cl labeled toxaphene were initiated. *Spartina alterniflora* was grown in sea water media for 26 and 100 days in a controlled environmental chamber. The greatest uptake was found in the roots and rhizomes. The least uptake was found in the leaves. Continued monitoring of toxaphene in the fauna of Terry Creek suggests as before that the oyster is not as good a biological monitoring organism as is the common anchovy. Toxaphene concentrations in the white shrimp are higher in the head and thorax than in the abdomen although the concentrations are much lower than found in preceding years. (Author abstract by permission)

76-0894. Nisbet, I. C. T. (Author address not given). **How have the persistent chlorinated hydrocarbons become global?** *Technol. Rev.* 77(3): 6-7; 1975.

The identification of DDT and other persistent chlorinated hydrocarbons in remote parts of the world was one of the greatest environmental surprises of the late 1950s and early 1960s. The second environmental surprise was the extent to which predatory birds, mammals, or fish were able to accumulate and store residues of these persistent chlorinated hydrocarbons. Even substances with low vapor pressures can volatilize to a significant extent over periods of years. Such volatilization is one means by which these chemicals are moved over the globe. Additionally, agricultural soils are porous and are repeatedly permeated with rain water, which then evaporates. This provides an extremely efficient steam distillation system which leads to rapid volatilization of certain pesticides. Many of these chemicals have actually been disseminated in large quantities directly into the air. One significant route of loss, for example, of PCBs is thought to be volatilization from scrap materials in burning dumps. In the spray application of several pesticides, only 40 to 70% reaches the ground, and much of this amount is evaporated within a few hours unless it is immediately turned over in the soil. It is now known that most chlorinated hydrocarbons are not very freely transferred from land into waterways, because they are strongly adsorbed to soil particles. The principal means of transfer into water appears to be by erosion of contaminated soil particles, particularly important for pesticides such as aldrin and heptachlor. The principal significance of discharges into water, even though they are very limited, is that they lead locally to very high accumulations of pesticide and PCB residues wherever the sediments are deposited, creating pollutant traps. Putting these various observations together leads to four major sinks of pollution contamination and spread: the biodegradation in soils and sediments, photochemical degradation in the atmosphere, sequestration in shallow-water sediments, and transfer to deep oceans.

76-0895. Schwab, G. O.; McLean, E. O.; Waldron, A. C.; White, R. K.; Michener, D. W. (Agric. Eng. Dep., Ohio State Univ., Columbus, OH). **Quality of drainage water from a heavy-textured soil.** *Trans. ASAE (Am. Soc. Agric. Eng.)* 16(6): 1104-1107; 1973. (11 references)

A study was conducted to measure the quantities of fertilizer nutrients and pesticides which were removed in drainage water from agricultural land, to evaluate different drainage methods, and to determine rates and types of leaching of phosphorus. Most of the results are based on field studies on Toledo silty clay soil at the North Central Branch of the Ohio Agricultural Research and Development Center in Ohio. Sediment, dissolved solids, nine chemical elements or ions, five pesticides, electrical conductivity, pH, and BOD in tile drainage effluent and in surface runoff were measured. Both conventional tilled and no tilled plots were used in continuous corn. Recommended fertilizer amounts were applied. Greater than normally-required amounts of insecticides were used, however. Sediment losses were about the same in the tile effluent and in the surface runoff. Sediment losses from tile and surface drainage water were several times greater for conventional tillage than for no tillage. Nitrate nitrogen losses were generally low, and were about the same from

the tile as from surface runoff, but slightly higher for conventional tillage than for no tillage. Phosphorus losses were less than 1.5 lb/acre/yr, but were greater in the surface runoff than in the tile effluent. Potassium losses in surface runoff were 10-13 compared to 4 lb/acre/yr in the tile effluent. Bicarbonate, chlorine, and sodium losses were higher in the tile effluent than in the surface runoff. Average atrazine and dicamba losses from rainfall were low. Application of irrigation water shortly after application, however, greatly increases losses of atrazine and dicamba. Aldrin and heptachlor losses were insignificant. The average electrical conductivity of the tile effluent and the surface runoff from rainfall were about the same. The BOD of the drainage water was insignificant. Laboratory studies showed than an increase in P application caused an increase in the P in the leachate and on the soil particles for all soils and crop covers. Losses of P were generally several times greater from bare than from cropped soils.

76-0896. Belov, V. N.; Kuchinskiy, A. L.; Mel'nik, M. L. (Mogilev Region Sanitary-Epidemiological Station, USSR). **Iz opyta kontrolya za primeneniem pestitsidov v sel'skom khozyaystve. [Monitoring the use of pesticides in agriculture.]** *Zdavookhr. Beloruss.* 20(12): 63-65; 1974. (2 references) (Russian)

Monitoring of the use of agricultural chemicals is described on the basis of systematic residue control in farm produce. Polychloropinene residues were found in 8% of 344 potato samples due to two applications of this pesticide. The replacement of polychloropinene by trichlorfon, cuprosan, or ziram for second treatment led to the absence of polychloropinene residues. Failure to comply with the instructions of pesticides concerning waiting periods and concentrations and the use of banned pesticides resulted in the presence of DDT in fruit, and of hexachlorane (BHC) and thiophos (parathion) in cabbage. The discontinued use of DDT and hexachlorane in chicken farms and in dairy buildings helped suppress the contamination of eggs and milk with these pesticides.

76-0897. Carter, G. E. (Clemson Univ., Clemson, SC 29631). **Chemical and microbial degradation of the substituted dinitroaniline herbicide, trifluralin.** *Diss. Abstr. Int.*34(7): 3102B; 1974.

Extracts of *Pseudomonas fluorescens* cultures growing in the presence of trifluralin were subjected to thin-layer chromatography. Analysis revealed four degradation products both in experimental cultures and in the *Ps. fluorescens*-free controls. The isolated products were compared with two standards, α,α,α-trifluoro- 2,6-dinitro-*N*-propyl-*p*- toluidine and 2,6-dinitro- 4-trifluromethylaniline; chromatography and spectrophotometry revealed possible divergence of products and standards. Infrared spectra of a third degradation product suggested the presence of a COOH group on the ring. $^{14}CO_2$ was recovered from a reaction flask containing trifluralin labeled on the *p*-carbon; dealkylation of the amine nitrogen was suggested. Trifluralin thus seems to undergo chemical degradation in which the *p*-carbon is converted to a COOH derivative, with decarboxylation resulting in loss of CO_2 and subsequent dealkylation of amine nitrogen. This degradation occurs independent of light, temperature, and solvent conditions. Soil microbial enrichment studies were performed with the goal of enhancing trifluralin degradation. Bacterial populations were adversely affected by the repeated application of trifluralin, but numbers of fungi and actinomycetes were increased. *Fusarium solani* and *Pseudomonas* spp. were isolated from the enrichment experiments as the predominant soil flora. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-31,386.)

76-0898. Petrocelli, S. R. (Texas A&M Univ., College Station, TX 77843). **The interactions of a chlorinated hydrocarbon insecticide among the water, sediments and biota in an estuarine system.** *Diss. Abstr. Int.* 34(7): 3109B-3110B; 1974.

Analyses of water, sediment, and biota from the San Antonio Bay estuarine system revealed a relatively low level of contamination (ppb range) by chlorinated hydrocarbon insecticides. Blue crabs had a greater incidence of contamination (dieldrin 32%, DDTs 94%) detectable by gas chromatography than any other organisms studied. Residues were found in oysters (dieldrin 25%, DDTs 60%), clams (dieldrin 31%, DDTs 68%), and a lesser number of Penaeid shrimp (dieldrin 26%, DDTs 13%). In laboratory experiments sediments from San Antonio Bay and the Aransas Refuge shore rapidly absorbed up to 80% of the dieldrin present in a seawater solution. Only 10-12% of adsorbed dieldrin was released upon transfer to clean seawater. Bivalve molluscs, *Rangia cuneata* and *Crassostrea virginica*, accumulated dieldrin to 10-23% of the initial content of the sediment when exposed in a flowing seawater system. *Rangia* accumulated dieldrin directly from seawater to 3517 times ambient levels. The marine phytoplankter *Dunaliella peircei* took up dieldrin directly from seawater to 1210 times ambient. *Rangia* fed contaminated algae accumulated dieldrin residues in their tissues to a level of 54 times initial algae residue concentration. Blue crabs (*Callinectes sapidus*) fed dieldrin-contaminated *Rangia* meat had dieldrin magnification factors of up to 6.8. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-1043.)

76-0899. Eiker, W. M. (Univ. Florida, Gainesville, FL 32601). **Loss patterns of bensulide, nitralin and trifluralin in sandy soil.** *Diss. Abstr. Int.* 34(10): 4762B; 1974.

The dissipation of bensulide, nitralin, and trifluralin were studied as a function of season, rate, and frequency of application at Bradenton and Gainesville, Florida, in a Leon fine sand soil. A foxtail millet bioassay was used. Herbicide residues were more phytotoxic and persistent in the soil at Bradenton, which contained less

organic matter and had a higher pH than the soil at Gainesville. Complete dissipation of bensulide residues took 8-10 mo at an application rate of 5 lb/acre, and dissipation of nitralin or trifluralin applied at 1 lb/acre took 6-8 mo. Doubling the application rate resulted in ca. 2 mo longer persistence of each herbicide. Season of application affected dissipation at Gainesville but not Bradenton. Degradation of bensulide and nitralin was increased by increased soil temperature and increased soil organic matter content but decreased with increasing pH. No evidence of volatile loss of either nitralin or bensulide from soil was found. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-9598.)

76-0900. Clapp, D. W. (Univ. Idaho, Moscow, ID 83843). **Di-syston (*O,O*-diethyl *S*-(2-ethylthio) ethyl) phosphorodithioate) degradation in soil.** *Diss. Abstr. Int.* 35(1): 635B-636B; 1974.

The effects of various soil and environmental factors on disyston (disulfoton) stability and the production of disyston sulfone in soil were studied. Disyston degradation in six different soils resulted in production of disyston sulfone and other products; however, the latter did not persist in soil. Disyston was adsorbed on Portneuf silt loam. Acetone when used as a solvent to add disyston to soil slowed the disappearance of disyston. Acetone could affect either the degradation or the adsorption reaction or both. Incubation temperature and initial dysyston concentration affected the disyston degradation rate. The effect of incubation temperature seemed to be moisture dependent. The most rapid degradation occurred at 20% water, 10 μg disyston, and 20°C. The six Western U.S. soils studied in the laboratory could be placed in two groups based on degradation rate. The first group included Portneuf and Ephrata soils which rapidly degraded disyston. The second group included Palouse, Panoche, Molokai, and Glendale soils. Degradation rates did not correlate with organic matter content. Disyston sulfone production followed disyston degradation. Except for the Palouse soil, the soils that degraded disyston more rapidly produced more sulfone. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-17,641.)

76-0901. Wilson, R. G., Jr. (Washington State Univ., Pullman, WA 99163). **Breakdown and movement of formulated 2,4-D compounds in soil-water systems.** *Diss. Abstr. Int.* 36(7): 3163B; 1976.

Studies were performed to compare the fate and behavior of the dimethylamine salt and isoctyl ester formulations of 2,4-D in soil-water systems under the specific environmental conditions of southeastern Washington. Greater 2,4-D adsorption occurred near the soil surface than at lower depth of the soil profile, and the percentage of 2,4-D adsorbed increased as the amount of 2,4-D present decreased. Some desorption of 2,4-D from soil colloids occurred when 2,4-D concentration in soil solution was decreased. In the laboratory 2,4-D applied to moist soil hydrolyzed rapidly to the anion—90% in 96 hr. Amine and ester formulations were degraded at similar rates under winter wheat and fallow cropping schemes at rates of about 1 and 10 kg/hr in the first 45 days after herbicide application. Then the breakdown of 2,4-D amine and ester decreased, and an average of 0.03 ppm 2,4-D remained in the soil after 6 months. Losses of 2,4-D amine and ester from irrigated field plots were similar. The herbicide leached into the soil profile with irrigation water, then returned toward the soil surface with upflowing capillary water when the soil surface was dry. Breakdown of 2,4-D was initially faster in soil than in runoff, yet total degradation was greater in runoff than in soil in laboratory studies. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 76-355.)

76-0902. Lane, L. G. (Mississippi State Univ., State College, MS 39762). **The effects of thermal processing and cooking methods on residues of DDT and its metabolites in beef.** *Diss. Abstr. Int.* 36(7): 3294B; 1976.

The effects of two thermal processes and two cooking methods on natural residues of DDT and metabolites in beef were studied at Mississippi State University. Pesticide residue analyses were done by aluminum oxide cleanup of fat and electron capture gas chromatographic determination. A 66 minute Steritort process at 260°F was found to cause less decrease of pesticide levels in beef than processing for 342 minutes at 220°F, cooking by microwave energy, or cooking by broiling. No differences in pesticide loss were attributed to the 220°F Steritort process, the microwave cook, and the broil cook. Samples were spiked by adding *p,p'*-DDT in ethanol-water solution to ground beef. Two treatments, a 220°F Steritort process for 342 minutes and broiling beef patties for four minutes on each side, were found to cause different losses of pesticides. Broiling was less effective than Steritort processing in causing pesticide reduction. In contrast, the study with naturally contaminated beef indicated there was no difference in the decrease of pesticide levels caused by these two treatments. Results indicated that research with pesticide residues should be conducted with naturally contaminated matrices rather than artificially spiked. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 76-79.)

See also **76-0932** **76-0941** **76-0947**

76-0903. Katzenelson, M. (Author address not given). **Depopulation of hives in Argentina. Causes.** *Apiacta* 9(1): 15-16; 1974.

A study determined that the causes of depopulation of apiaries in Argentina until the autumn of 1973 were: European foulbrood, discontinuation of queen's egglaying, pesticide application, virus diseases, and unknown causes. The effect of pesticides on bees is very well documented elsewhere. It is recommended that the problems caused by these chemicals can be prevented in part by keeping the beekeepers informed about methods of poison prevention and in part by persuading people who apply pesticides to use those which are not harmful to bees.

76-0904. Van Dijk, A.; Maes, R. A. A.; Drost, R. H.; Douze, J. M. C.; Van Heyst, A. N. P. (Cent. Human Toxicol., Univ. Utrecht, Utrecht, The Netherlands). **Paraquat poisoning in man.** *Arch. Toxicol.* 34(2): 29-136; 1975. (6 references)

In three cases of intoxication by Gramoxone, the concentration of paraquat dichloride in blood, dialysate, feces, and urine was determined spectrophotometrically after a clean-up of the biological material by means of ion exchange chromatography (with Dowex 50W-X12 or Zeo-Karb 225). Although good results were obtained after clean-up with Dowex 50W-X12, Zeo-Karb was preferred as ion exchange resin, especially when large sample volumes were needed for the determination. The reported findings indicate that: only 5 to 10% of an ingested dose of paraquat dichloride is absorbed in man, Fullers' earth is very useful, and that primary, e.g. immediate, hemodialysis is necessary. (Author abstract by permission)

76-0905. Pugh, W. S. (P.O. Box 728, Forest, Ontario, Canada). **An outbreak of organophosphate poisoning (Thimet) in cattle.** *Can. Vet. J.* 16(2): 56-58; 1975. (4 references)

Twenty-six hereford heifers became ill over a 6 day period. Clinical signs included: protrusion of the tongue, excessive salivation, respiratory dyspnea, extension of the tail, dribbling urine, and staggering. Muscular tremors were first noted in the shoulders and forelimbs and then progressed posteriorly over the whole body. Eventually the heifers went into sternal and then lateral recumbency due to paresis of the legs. The condition was always progressive. The heifers in lateral recumbency became dull, appeared cyanotic, and finally died. The course of the illness usually lasted from 15 min to one hr. All animals which were found recumbent and unable to rise died. Those treated in an earlier stage of illness survived. Fourteen of the heifers died. A diagnosis of organophosphate poisoning by Thimet (phorate) was made based on clinical signs, toxicology, history, and response to treatment. Initial treatment was symptomatic with a tentative diagnosis of infectious thromboembolic meningoencephalitis. The heifers were given 2.5 g chloramphenicol, and 1 g thiamin hydrochloride, i.v., and 40 mg atropine sulfate, s.c. After the diagnosis of organophosphate poisoning was advanced, the animals were treated with 0.25 mg/kg atropine sulfate every 5 hr. A dirt sample from the manger was found heavily contaminated and the heifers being fed from the ground suffered intoxication both by inhalation and ingestion. The fact that the outbreak did not occur for a full two weeks after the last animals arrived at the feedlot is due to the cumulative effect of the organophosphates by the progressive inhibition of cholinesterase. While transporting two carcasses to a laboratory, the owner placed a sample of contaminated dirt in the cab of the pick-up truck and ten hr after the two hr journey, his wife, who had accompanied him to the lab, began to show signs of organophosphate poisoning. Treatment with atropine alleviated all her symptoms in 12 hr. The route of absorption, in her case, was through inhalation as she had not handled the sample and it was contained in a polyethylene bread wrapper. The potency of this group of insecticides needs to be re-emphasized to all groups of people in agriculture.

76-0906. Anonymous. **EEC agreement on pollution proposals.** *Chem. Ind. (London)* 1: 22; 1976.

On December 8, 1975, the Council of Environment Ministers of the European Community in Brussels agreed upon proposals for dealing with pollution of the Community's rivers and seas. According to these proposals, the Community shall set uniform emission standards and quality objectives for each "black list" substance; member states will be able to choose which methods of implementation they wish to adopt. Black list substances include organohalogen compounds, organophosphorus compounds, organotin compounds, substances which exhibit carcinogenic activity in the aquatic environment, mercury and cadmium and their compounds, persistent mineral oils and hydrocarbons of petroleum origin, and persistent synthetic substances which may interfere with any use of the waters. No provision was made for uniform emission standards to apply to "grey list" substances. The latter include various metals and metalloids, toxic or persistent silicon compounds, phosphorus and its inorganic compounds, nonpersistent mineral oils and hydrocarbons of petroleum origin, cyanides and fluorides, and substances which have an adverse effect on the oxygen balance or on the taste and/or smell of aquatic products for human consumption.

76-0907. Kundiev, Yu. I.; Nikitin, D. P.; Erman, M. I.; Khokhol'kova, G. A. (Kiev Sci. Res. Inst. Ind. Hyg. Occup. Dis., USSR). **Novye gigienicheskie problemy, svyazannye s shirokoy khimizatsiey sel'skokhozyaystvennogo proizvodstva. [New hygienic problems arising in connection with chemicalization of agriculture.]** *Gig. Sanit.* 10: 6-10; 1975. (16 references) (Russian)

The ever-increasing use of pesticides in agriculture

entails residue problems in farm products, the possibility of metabolism to more toxic substances in the soil, and acute poisoning hazards for farm workers not handling pesticides directly. Acute poisonings observed among farm workers in fields previously treated with polychloropinene were not found to be due to this pesticide, as it was not detected in the air at the time when the poisonings occurred. However, such toxic metabolites as phosgen, hydrochloric acid, and chlorine were detected in the air. Arthrobacter sp. was found to degrade 2,4-D in the soil. Lindane is decomposed into an unidentified metabolite and chlorine by Clostridium sp. Wofatox, diazinon, carbophos, dichlorvos, rogor, and thiophos are decomposed by soil microorganisms.

76-0908. Lazar, E. C. (Hazard. Waste Manage. Div., Off. Solid Waste Manage. Programs, U.S. Environ. Protect. Agency, Washington, DC 20460). **Damage incidents from improper land disposal.** *J. Hazardous Mater.* 1(2): 157-164; 1976. (2 references)

An overview is presented of the types of damage which result from improper land disposal of hazardous wastes. Most cases of toxic exposure to hazardous pollutants manifest themselves in insidious chronic effects and it is rarely possible to trace these to the causative agents. There are six major routes of environmental transport through which the improper land disposal of hazardous wastes can result in damage. These include groundwater contamination via leachate; surface water contamination via runoff; air pollution via open burning, evaporation, sublimation, and wind erosion; poisoning via direct contact; poisoning via the food chain; and fire and explosion. The major perils inherent in groundwater contamination are the elusive nature and long duration of the problem. For example, 11 persons developed symptoms of arsenic poisoning in 1972 in Minnesota as a result of burying arsenic-containing pesticides in the mid-1930s. Even relatively insoluble industrial solid wastes that are dumped on land ultimately find their way into surface waters through natural runoff. Often the harmful effects of wastes dumped on land are transmitted to the environment through the medium of air. Wind erosion of harmful dusts from land-disposed solid wastes is not only an occupational hazard for landfill operators, but can affect the health of area residents as well. Poisoning by direct contact is very common for extremely toxic wastes, including surplus pesticides and pesticide containers. Examples of poisoning with organophosphate insecticides include a 2 1/2 year old child who had been playing among a pile of 55-gal drums. The drums had contained various pesticides, including methyl parathion, ethyl parathion, toxaphene, DDT, and others. They were located about 50 ft from the child's home. In another example, Di-Syston was added to the soil in a potato field and the "empty" paper bags which had held the chemical were left in the fields. The wind blew the bags to an adjacent field and 14 head of cattle died after licking the bags. At least 18 persons were hospitalized and 2 firemen suffered permanent lung damage after inhaling a nematocide emanating from an undepleted 300-lb pressurized canister which had been improperly disposed of by the manufacturer. A businessman had secured the canister to make a standup fireplace. How land-disposed wastes can become health hazards by entering the food chain is also described. Damage caused by fire and explosion are avoidable if proper safety precautions are followed.

76-0909. Wolfe, H. R.; Armstrong, J. F.; Durham, W. F. (U.S. Environ. Protect. Ag., Wenatchee, WA 98801). **Exposure of mosquito control workers to fenthion.** *Mosq. News* 34(3): 263-267; 1974. (4 references)

Observations were made of the application of fenthion by mosquito control workers and studies were conducted to determine the potential exposure to fenthion during field application operations. Application was in the form of 0.06% spray or hand dispersal of the 1% granular formulation. Thirty-three different work periods were studied, 12 during operation of hand gun power sprayers, 10 during back-pack hand pressure sprayer operations, and 11 during granular dispersal. The results of the study indicated that the calculated potential exposure values for workers during operation of power sprayers or back-pack hand pressure sprayers were about the same. During hand granular dispersal the values were over 3 times greater than those for spraying activities. In all 3 operations, the unprotected parts of the body subjected to the greatest exposure were the hands, with only slightly less exposure to the forearms. Dust from the granular formulation was undoubtedly an important factor in respiratory exposure. Although a wide range of potential exposure in different work periods or situations was seen, the individual with the greatest potential exposure would be subjected to only 0.03% of a toxic dose of fenthion/hr of work. This maximum exposure level would probably rarely be maintained throughout a full day of work. In a study involving the contamination of cigarettes carried onto the field during spraying or dusting operations, it was found that workers dispersing dry granular fenthion had cigarettes which were contaminated with from 137.2 to 233.0 mg of fenthion/cigarette, while those who used sprayers showed cigarette contamination ranging from 3.2 to 78.5 mg/cigarette. In a study of blood cholinesterase levels in 9 workers, no significant effects were found on either the erythrocyte or plasma cholinesterase levels, during a period when other less toxic compounds were being used along with the fenthion. However, during a period when fenthion use was heavy, 8 of the 9 workers showed plasma cholinesterase levels which had suffered a progressive decrease over the work season. There appeared to be good correlation between magnitude of cholinesterase decrease and apparent exposure to fenthion. Although the results of this study are interpreted to mean that there is no appreciable hazard to workers applying fenthion for mosquito control under these conditions, in light of the lowered plasma cholinesterase values, efforts to keep exposure to a minimum should be maintained.

76-0910. Shih, C. C.; Tobias, R. F.; Clausen, J. F.; Johnson, R. J. (TRW Systems Group, Redondo Beach, CA). **Thermal degradation of military standard pesticide formulations.** *Natl. Tech. Inform. Serv.*, AD-A008 023, 1975, 279 p. (4 references)

The disposal of surplus military standard pesticide formulations is a serious environmental problem that has caused growing concern in recent years. The present TRW study was aimed at providing key experimental data for the design of a prototype pesticide incineration system. A total of 14 chlorinated hydrocarbon military standard pesticide formulations have been investigated in the laboratory-scale incinerator, and it has been demonstrated that incineration is an extremely efficient process for the safe disposal of these pesticide formulations. Based on the experimental data, a minimum residence time of 0.4 second at temperatures above 1845°F and excess air in the range of 45 to 60 percent is recommended as the operating region for pesticide incineration. In addition, supplementary experiments indicated that pesticide incineration has little or no effect on the combustion chamber refractory liners, and that no significant agglomeration or breakdown of the dust particles would take place in the incineration of the dust formulations. (Author abstract by permission)

76-0911. Sorber, C. A. (US Army Med. Environ. Eng. Res. Unit, Aberdeen Proving Ground, MD 21010). **Evaluation of the health effects of the chemical disposal of pesticides and pesticide containers.** *Natl. Tech. Inform. Serv.*, AD-769 616, 1973, 52 p.

Health aspects were studied of the chemical decontamination of empty pesticide containers and excess pesticide formulations generated by pest control operations at Army installations. Guidelines were developed for the safe use of chemical decontamination systems. Laboratory tests were designed to measure decomposition rates and identify reaction products when pesticides were subjected to various chemical systems which produce a reasonably short half-life in the parent compound. On-site studies were planned to evaluate the health aspects and effectiveness of the use of these systems in an operational situation. A literature review was completed and potential chemical systems were identified.

76-0912. Ramus, J. S. (Dep. Biol., Yale Univ., New Haven, CT 06520). **Studies directed toward methods for control of *Codium fragile* in Long Island Sound.** *Natl. Tech. Inform. Serv.*, COM-75-10459, 1974, 10 p.

Codium fragile, a seaweed which is a serious hindrance to the oyster fisheries of Long Island Sound, adversely affects the commercial bottom culture of oysters. The large green marine alga reproduce rapidly by perennation, fragmentation, and swarmers. Growth can be started on any stable object, even shellfish. Extensive growth of *Codium* produces many dead, moribund, and stunted oysters which require an economically unprofitable amount of labor to either harvest or prepare for market. Chemical control is risky due to the possibility of introducing toxic compounds which persist in the marine environment, with the exception of quicklime. The least attractive of all possible control measures is the introduction of aquatic herbicides to oyster beds. Any herbicide which is effective against *Codium* will, in all probability, be effective against phytoplankton as well, and thus eliminate the oyster's food supply. Little data exists on the effects of herbicides on oysters, either in terms of mortality or fouling of the nest.

76-0913. Moore, E. (Environ. Protect. Agency, Seattle, WA). **Environmental evaluation, Boise district, Bureau of Land Management.** *Natl. Tech. Inform. Serv.*, PB-227 154, 1973, 85 p.

The Bureau of Land Management environmental control programs were studied and their effectiveness assessed in terms of field conditions. Pesticide uses were included in this study. Pest control programs are planned for two areas, both of which are open range with dense stands of big sage-brush. Treatment is planned on a block pattern basis. The herbicide 2,4-D will be applied at a rate of 1 kg active ingredient per 0.41 hectares. The formulation proposed is 3 kg/4 l water emulsion with aerial application by helicopter. It was recommended that an environmental impact statement be prepared, particularly concerning these two projects; that the personnel employed in these programs be certified pesticide public operators; that contractors used for pesticide applications be required to define methods and locations for disposal of pesticide residues and containers; and that plans for handling accidental spills involving pesticides be included in contingency planning.

76-0914. Illinois Inst. Environ. Qual. (Environ. Health Resour. Cent., Univ. Illinois at Med. Cent., Chicago, IL 60680). **Health effects of organophosphate insecticides.** *Natl. Tech. Inform. Serv.*, PB-228 439, 1974, 58 p. (76 references)

This report identifies the health effects associated with exposure to organophosphate insecticides. The study was undertaken because organophosphate insecticides are rapidly replacing organochlorines. While the organophosphates are generally less persistent in the environment than organochlorines, they are also considered much more toxic to man and insects. They act by inhibiting the enzyme cholinesterase, which disrupts the human nervous system. The following recommendations were made: improvements should be made in the hazard warnings on labels to make them more clearly understood and more noticeable; tighter controls over unsafe storage and handling must be established; a system for grading pesticides on the basis of effectiveness, human safety, and lack of nontarget effects should be adopted; unnecessary exposure of high risk populations must be avoided; and monitoring of air, water, and food for organophosphate pesticides should be established. (Author abstract by permission)

76-0915. Osmun, J. V. (Environ. Protect. Agency, Washington, DC 20406). **What new pesticide regulation means in terms of entomology at this time.** *Proc. N. Cent. Br., Entomol. Soc. Am.* 29: 26-31; 1974.

The new laws and regulations, particularly those related to pesticides, place new responsibilities on entomologists. The Federal Insecticide, Fungicide, and Rodenticide Act of 1972 pre-empted most state registration of pesticides and thus centralized this function at the federal level. It placed the responsibility for misuse on the user; mandated a pesticide classification system; provided certification programs based on standards of applicator competency; established a state-federal administration of portions of the act; restructured the experimental use permit system; provided emergency contingencies related to federal and state agencies; provided that the EPA impose other restrictions as deemed necessary; identified unlawful acts and provided enforcement provisions; and enabled the EPA to enter into agreements to encourage training. Many division activities of the EPA have a direct effect on entomology. These divisions include: registration, criteria and evaluation, operations, technical services, strategic studies support, office of pesticide programs, research and development, and enforcement and general counsel. There are several broad effects these activities have as they relate to entomology. A great focus of attention has come about on the environmental impact of pesticides.The general public expects the entomologist to know why certain pesticides are classified as general or restricted use. The exploitation of uses will no longer be possible. Anyone applying or supervising the use of restricted use pesticides will have to be certified. The classification of undesirable viruses, bacteria, and micro-organisms as pests subjects them to the constraints of the federal act. It is urged that entomologists have active input into the development of new laws and recommendations. In order to do this, education must be improved to provide an interdisciplinary approach.

76-0916. Crosby, D. G. (Dep. Environ. Toxicol., Univ. California, Davis, CA). **The toxicant-wildlife complex.** *Pure Appl. Chem.* 42(1-2): 233-253; 1976. (108 references)

Of the approximately one million animal species accounted for on earth today, at least 700,000 are insects and 250,000 are other invertebrates; familiar vertebrate wildlife comprises less than 5% of the animal kingdom. A major proportion of the other non-insect species are aquatic and will be increasingly exposed to a wide variety of manmade and natural chemicals, including pesticides. Effective management of this toxicant-wildlife complex demands general and simple means for the prediction and estimation of effects and hazards. Direct, nonfood exposure to toxicants is much more extensive than was expected and the bioconcentration of persistent compounds may be approximated by their lipid-water partition coefficients. Simple measures of distribution into soil organic matter and biota, environmental degradation, and toxicity then provide an estimate of relative hazard. This estimate is extended and verified by both direct measurement and comparison of the metabolites excreted by aquatic species and by the predictive in vitro simulation of primary metabolism. These generalizations suggest that the bioconcentration of stable substances will usually depend upon the fat content of the individual organism, that it may not be strongly affected by metabolism, that it will not inevitably lead to "biomagnification," and that it will become increasingly predictive.

76-0917. Nisbet, I. C. T. (Author address not given). **Pesticides and breeding failure in birds.** *Technol. Rev.* 77(7): 8-9; 1975.

Present indications suggest that virtually all fish-eating birds and birds of prey have been affected, at least minimally, by thinning of eggshells caused by pesticide usage. In at least 25 species the degree of eggshell-thinning has been shown to vary in proportion with concentrations of chlorinated hydrocarbons, especially DDE, in the eggs. During the last two years some wild species have shown partial recoveries as levels of environmental contamination have dropped. A number of recent studies have suggested that DDE is the only chemical significantly associated with eggshell-thinning in captive species, the degree and duration of which can exceed one yr after exposure. PCBs appear to have little or no effect, except to potentiate the action of DDE. The response to DDE varies markedly from species to species. The dose-response relation is peculiar, being steep at first so that small doses produce a large initial response, but becoming progressively less steep at higher doses. Recent studies ahve shown that DDE is related not only to thin eggshells, but also to shells which are less porous, so that the oxygen supply to the embryo is reduced at critical periods of growth. DDE is also directly toxic to embryos, which may die from this cause alone. Deaths of chicks after hatching have been associated with exposure to dieldrin and several other chemicals. Dieldrin, PCBs, and DDE have all been associated with abnormal behavior of chicks hatching from contaminated eggs.

76-0918. Pesic, V.; Brankov, K.; Hadzovic, S. (Dep. Pharmacol. Toxicol., Vet. Fac. Sarajevo, Yugoslavia). **Noguchosti terapije svinja otrovanih organofosfornim jedinjenjima. [Therapy of swine poisoned with organophosphorus compounds.]** *Veterinaria (Sarajevo)* 23(1): 47-52; 1974. (27 references) (Serbo-Croatian)

Studies were conducted in an effort to find a therapy for organophosphorus compound poisoning. The main emphasis of the study was on the treatment of swine. First it was necessary to determine the LD50 for sarin so that acute poisoning of experimental swine could be induced. In the second phase of the experimentation, 10 swine were given 20 μg/kg of sarin, i.v. (2 times the LD50). When the clinical picture of organophosphate poisoning was complete, the animals were given atropine sulfate in a

dose of 15 mg/kg. Both were given i.m. This therapy was entirely successful with all swine surviving. As the mechanism of action of all organophosphorus compounds is the same, it is suggested that the above therapy would be successful also in swine poisoned with other organophosphorus compounds.

See also **76-0892** **76-0984** **76-0986** **76-1020**

76-0919. Kreczko, S.; Zwierz, K.; Jaroszewicz, K. (Lab. District Ind. Outpatient Dep., Bialystok, Poland). **Glycoprotein biosynthesis by the guinea pig liver in chronic 4,6-dinitro-*o*-cresol poisoning.** *Acta Biol. Acad. Sci. Hung.* 25(3): 167-171; 1974.

A study was made of the influence of dinitro-*o*-cresol (DNOC) intoxication on the biosynthesis of glycoproteins in the liver of the guinea pig. A group of 30 male guinea pigs received a daily dose of 0.3 LD50 DNOC in 0.5 ml 0.9% sodium chloride solution i.p. over a 30 day period, 6 times a week. The LD50 was accepted to be 30 mg/kg. The concentration of DNOC in the blood of the poisoned animals varied from 21 μg/ml to 32 μg/ml, with an average of 30 μg/ml. The aminosugar and sialic acid contents were significantly higher in both the liver and serum of the poisoned animals. The serum of poisoned animals showed decreases in the glycoprotein content of the albumin and α globulin fractions, with a simultaneous increase in the α and gamma globulin fractions. A slight increase was noted in the β globulin fraction. The most significant increase was noted in the glycoprotein content of the α globulin fraction, the fraction which had the highest percentage of sugar in the molecule. The significant increases in the liver aminosugar and sialic acid contents can be explained by the increase in biosynthesis of glycoproteins in this organ. DNOC can also stimulate the secretion of completed glycoproteins into the blood stream, which may explain the significant increase in serum aminosugars and glycoproteins. These findings suggest that DNOC selectively blocks the biosynthesis of some proteins and/or stimulates that of the others, particularly those containing high amounts of sugar in the molecule. The increased biosynthesis of sugars in the liver and the raised serum glycoprotein levels in chronic DNOC intoxication may be due to increased availability of sugar phosphates in the course of stimulation by DNOC glycolysis and/or reaction to toxic damage of the liver lysosomes by DNOC.

76-0920. Ando, M.; Wakisaka, I. (Dep. Pub. Health, Fac. Med., Kagoshima Univ., Kagoshima, Japan). **DDT residue and its effect on the level of liver triglyceride.** *Acta Med. Univ. Kagoshima* 16(2): 101-106; 1974. (14 references)

This paper reports the results of measurements on the DDT concentration in some organs and liver triglyceride content in rats exposed to DDT. In the first of 2 controlled trials 10 male Wistar rats were given 7.14 to 113 mg/kg DDT p.o. in peanut oil as a single dose. The rats were killed on the 13th day after dosing. Omental fat, liver, brain, and testis specimens were taken. In the second trial 4 male Wistar rats received a single dose of 5.29 to 23.4 mg/kg DDT in peanut oil p.o. Liver specimens were taken on the 14th day after dosing. Doses of DDT up to the 29.4 mg/kg level did not inhibit growth in the rat. However, in the rat given a single dose of 113 mg/kg, there was no body-weight gain during the first 11 days after dosing and then only a slight increase occurred. The highest storage level of DDT was seen in fatty tissue. Storage levels of DDT in the organs were nearly proportional to the single oral dose. The concentration of DDE in each tissue was related to the single oral dose of DDT. Only at the higher dose level of 113 mg/kg was the DDE in fat not proportional to the dose of DDT given, which is taken to mean that the rate of metabolism of DDT to DDE at high levels of dosing may be slower than at low levels. The level of liver triglyceride decreased significantly according to the oral dose of DDT. The minimum single oral dose of DDT which affected the liver triglyceride was 10 mg/kg.

76-0921. Vainio, H.; Parkki, M. G.(Dep. Physiol., Univ. Turku, Turku, 52, Finland). **Deterioration of drug biotransformation in rat liver by a fungicide dichlone.** *Acta Physiol. Scand.* 95(2): 60A-61A; 1975. (2 references)

The fungicide, dichlone, was administered i.p. to rats at doses of 2, 5, and 10 mg/kg. The 10 mg/kg dose was very lethal to rats: only 1 of 8 rats survived 24 hr after dosing. Dichlone produced a great decline in the activities of the drug hydroxylation reactions. Both hydroxylation of 3,4-benzpyrene and *O*-demethylation of *p*-nitroanisole were decreased to about 50% of control with a 5 mg/kg dose. At this dose level the NADPH cytochrome c reductase activity decreased 40% and the content of cytochrome P-450 in liver microsomes declined 50%. The microsomal enzyme acting on epoxides, epoxide hydrase, was similarly inhibited. UDPglucuronosyltransferase activity was not detectably altered by dichlone, not even in microsomes treated in vitro with digitonin and trypsin to detect the latent transferase activity. The results of this study indicate that dichlone is toxic for rats, with the lethal dose of 10 mg/kg. The results support earlier suggestions of a more protected microenvironment of UDPglucuronosyltransferase in the microsomal membrane than the monooxygenase system.

76-0922. Redfern, R. E.; Knox, D. A. (U.S. Dep. Agric. Biol. Eval. Chem. Lab., Agric. Environ. Qual. Inst., ARS, Beltsville, MD 20705). **Adult honey bee: relative toxicity of two juvenile hormone analogues.** *Am. Bee J.* 114(12): 456-458; 1974. (16 references)

Two experimental compounds which have demonstrated good juvenile hormone (JH) activity against a number of insect species, have been relatively stable in the field, and have caused no toxicity in animals tested to date, were subjected to tests with honey bees, *Apis mellifera* L. For oral feeding tests the bees were starved for 3 to 4 hr and then force-fed individually with 1 μl of the test chemical formulated in 50% sugar syrup solution. The test chemicals were ZR-512 (Altozar containing 63.1% ethyl 3,7,11-trimethyldodeca-2,4-dienoate plus related materials), and ZR-515 (methoprene). The data indicates that these two materials were not directly toxic to the adult honey

76-0923. Timmons, E. H.; Chaklos, R. J.; Bannister, T. M.; Kaplan, K. M. (Vivarium, Southern Illinois Univ.,

Carbondale, IL 62901). **Dichlorvos effects on estrous cycle onset in the rat.** *Lab. Anim. Sci.* 25(1): 45-47; 1975. (17 references)

Fifty outbred female albino rats were randomly divided at weaning into control and experimental groups and placed in individual cages with mature males. One-half of a Shell "No-Pest Strip" was placed on top of each experimental cage. In another experiment, females were exposed to such a strip for 8-10 hr daily, and at 7-day intervals were sacrificed and their tissues examined by gas chromatography for DDVP residues. Rats exposed to dichlorvos came into their first estrous cycle significantly later than nonexposed controls. In the tissue deposition analysis, DDVP was recovered in almost all of the blood samples and all but one of the ovarian tissue samples. It was recoverable in minute quantities only occasionally from the adrenal, kidney, and brain samples. Des-methyl DDVP was not recovered from any of the tissue samples. The rats never exhibited any external somatic clinical signs of organic phosphorus poisoning.

76-0924. Wenger, B. S. (Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada). **Protease inhibition as a teratogenic mechanism.** *Am. Zool.* 14(4): 1305; 1974.

Parrot beak-micromelia is produced in the developing chick embryo by the administration of several cholinesterase inhibitors, including eserine and the insecticides Bidrin (dicrotophos) and malathion. This parrot beak-micromelia syndrome appears not to be related to the inhibition of acetylcholinesterase. It can be prevented by administering either nicotinamide or tryptophan. Two yolk sac proteases, identified as pH 2.9 and pH 6.7 enzymes, were inhibited in vitro by all drugs which produce the syndrome. It is concluded that the insecticides produce the syndrome by inhibiting yolk sac proteases, thus preventing mobilization of tryptophan as well as other amino acids from yolk proteins. This would result in reduced nicotinamide levels, leading ultimately to deficiencies in pyridine nucleotide dependent metabolic pathways.

76-0925. Munnecke, D. M.; Hsieh, D. P. H. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616). **Pathways of microbial metabolism of parathion.** *Appl. Environ. Microbiol.* 31(1): 63-69; 1976. (14 references)

As part of a study on the development of a mixed culture microbial system for the complete detoxification of concentrated aqueous suspensions of parathion, pathways used by a mixed culture to metabolize parathion were delineated and some metabolites remaining in the treated fluids were identified. A mixed bacterial culture consisting of a minimum of nine isolates was adapted to growth on technical parathion as a sole carbon and energy source. An initial hydrolysis to diethylthiophosphoric acid and *p*-nitrophenol was the primary oxidative pathway for parathion metabolism. The oxidation of parathion to paraoxon and then hydrolysis to *p*-nitrophenol and diethylphosphoric acid was a secondary pathway. Parathion hydrolase, an enzyme produced by an isolate from the mixed culture, rapidly hydrolyzed parathion and paraoxon (6.0 μmol/mg/min). This enzyme was inducible and stable at room temperature and retained 100% of its activity when heated at 55°C for 10 min.

76-0926. Tu, C. M. (Res. Inst., Agric. Can., London, Ontario, Canada). **Interaction between lindane and microbes in soils.** *Arch. Microbiol.* 105(2): 131-134; 1975. (18 references)

Three lindane (γ-1,2,3,4,5,6- hexachlorocyclohexane) treated soils were studied under laboratory conditions to determine the interaction between lindane and the soil microorganisms. Microbial populations and respiration were monitored to study insecticide effects. Formulation of lindane degradation products and chloride content were examined to determine effects of the microorganisms. Some populations in lindane treated soils showed temporary declines but all ultimately recovered to at least the level of the controls in 16 weeks. Respiration was stimulated over a 9 wk period especially in the sandy and clay loams, suggesting the possibility of microbial degradation of the insecticide. Lindane degradation products separated and identified by TLC included γ-2,3,4,5,6-pentachloro-1- cyclohexene (γ-PCCH), α-3,4,5,6-tetrachloro-1- cyclohexane (α-TCCH), γ-3,4,5,6-tetrachloro-1- cyclohexane (γ-TCCH), and pentachlorobenzene. Chloride production increased in soils treated with higher levels of lindane. (Author abstract by permission)

76-0927. Herbst, M.; Guenard, J.; Koellmer, H.; Stoetzer, H. (Abt. Exp. Pathol. Toxikol., C. H. Boehringer Soh, Ingelheim, Germany). **Zur Enzyminduktion in der Leber nach oraler Lindanapplikation. Funktionelle und morphologische Untersuchungen an Ratten. [Enzyme induction in the liver following administration of lindane by the oral route. A functional and morphological study in rats.]** *Arch. Toxicol.* 32(2): 115-118; 1974. (45 references) (German)

Following short-term oral administration of lindane (5 mg/kg, 20 mg/kg) to male rats, various functional, biochemical, histochemical, and electron-microscope investigations were performed. No effects of the lindane medication were found in movement and exploration (open-field test), liver weight, and the histochemically presented enzymes. A dose-dependent and time-dependent reduction in the duration of sleep was measured after i.p. pentobarbital. There were no differences in the liver glycogen levels of treated and control animals when food was available to the animals ad libitum. After food had been withdrawn for 24 hr a tendency to reduced liver glycogen was observed in the treated animals. The excretion of ascorbic acid in the urine was several times higher than normal, while the ascorbic acid concentration in blood serum was doubled (attributed to transport effects). The electron microscope revealed a distinct increase in the

smooth endoplasmic reticulum, particularly in hepatocytes of the intermediary zone. The observed increase in free ribosomes was thought to be connected with the intensified formation of microsomal protein. The reduced glycogen of individual cells, also observed with the electron microscope, was explained as a result of the change in metabolism caused by enzyme induction (increase in formation of glucuronic acid, increased ascorbic acid synthesis). In all, no hepatotoxic effects of the test substance were found with the given experimental procedure, so the functional and morphological equivalents of enzyme induction can be interpreted as adaptive changes. (Author abstract by permission)

76-0928. Haley, T. J.; Farmer, J. H.; Harmon, J. R.; Dooley, K. L. (Dep. Health Educ. Welfare, Food Drug Adm., Natl. Cent. Toxicol. Res., Jefferson, AR). **Estimation of the LD1 and extrapolation of the LD0.1 for five organophosphate pesticides.** *Arch. Toxicol.* 34(2): 103-109; 1975. (11 references)

The oral LD50 for 5 organophosphate pesticides have been determined in CD-1 strain male and female mice. The values in mg/kg are: trichlorfon, 800 and 800; naled, 409 and 330; dichlorvos, 139 and 133, GC6506, 23.4 and 17.8; fospirate, 225 and 263. Toxicity was greater in males with fospirate and greater in females with naled and GC6506. The predicted LD1s and the extrapolated LD0.1s have been determined for the 5 organophosphates from an unbalanced design, loaded heavily toward the lower end of the dose-response curve. It has been shown that the slopes of the curves obtained with 50, 100, and 660 animals are parallel for all compounds except fospirate in the 660 mouse experiments. This is probably related to excessive female deaths in the upper segment of the dose-response curve. Sex dependent lethality was observed with trichlorfon, dichlorvos, and fospirate with the males being more susceptible than the females except in the case of fospirate where there was a reversal at the LD50 with greater susceptibility in the females. The conditions for obtaining accurate results in such experiments have been established. The implications of human exposure to low levels of the environmental pollutants have been discussed. (Author abstract by permission)

76-0929. Deichmann, W. B.; MacDonald, W. E.; Cubit, D. A. (Res. and Teaching Cent. Toxicol., Univ. Miami, Sch. Med., Coral Gables, FL). **Dieldrin and DDT in the tissues of mice fed aldrin and DDT for seven generations.** *Arch. Toxicol.* 34(3): 173-182; 1975. (5 references)

The concentration and total retention of dieldrin or *p,p'*-DDT and metabolites were determined in the total carcass of Swiss-Webster (P-F_6) mice fed dietary supplements of aldrin 5 or 10 ppm, or DDT 100 ppm, to age 260 days. All groups showed a significant increase in total body retention (and concentration) of dieldrin or total DDT in the total carcass of the F_1, F_2, and F_3 generations. Generally, these increases were related directly to increases in total body lipids, when compared with the P generations. The control (pesticide-free) diet was fed to all F_4 generation experimental mice from weaning to age 260. The pesticides absorbed by these animals while in utero and via lactation were found, at the time of sacrifice, to have been excreted completely. When the experimental diets were resumed with the weanlings of the F_5 generations, a repetition of the general findings in the P and F_1 generations was noted, demonstrating that pesticide retention and total body lipids are closely interrelated, and that a high body lipid content favors a high retention rate of these fat-soluble pesticides. These results support earlier studies in rat and investigations with cirrhotic human livers with severe fatty infiltration. Conception became more delayed with each succeeding generation, requiring some degree of "selective" breeding of the F_4, F_5, F_6 generations. (Author abstract by permission)

76-0930. Koss, G.; Koransky, W. (Inst. Toxikol. Pharmakol., Univ. Marburg, Marburg, Germany). **Studies on the toxicology of hexachlorobenzene. I. Pharmacokinetics.** *Arch. Toxicol.* 34(3): 203-212; 1975. (26 references)

In female rats dosed orally with ^{14}C-hexachlorobenzene, the extent of intestinal absorption of carbon-14 has been found to be dependent on the form of application. When the substance was given as a solution in oil about 80% of the dose administered was absorbed, but when given as an aqueous suspension only 6%. In animals treated with ^{14}C-hexachlorobenzene dissolved in oil, all tissues contained radioactivity. Highest levels were found in adipose tissue, lowest in blood and muscle. Peak values of radioactivity were reached between 2 to 5 days after application. Elimination was studied after intraperitoneal application of 4 mg/kg ^{14}C-hexachlorobenzene dissolved in oil. Two weeks after administration, 34% of the radioactivity administered was recovered in the feces and 5% in urine. About 80% of carbon-14 excreted in feces and about 4% in urine was contained in the unchanged drug. This indicates that biodegradation of hexachlorobenzene in the rat is not insignificant. No radioactivity was detected in the expired air. (Author abstract by permission)

76-0931. Mertens, H. W.; Steen, J. A.; Lewis, M. F. (FAA Civil Aeromed. Inst., Oklahoma City, OK 73125). **Some behavioral effects of pesticides: the interaction of mevinphos and atropine in pigeons.** *Aviat. Space Environ. Med.* 47(2): 137-141; 1976. (31 references)

Experiments were conducted to examine the behavioral interaction of the insecticide mevinphos and the anticholinergic drug atropine. Two adult male King pigeons were used in the studies. There were 3 drug series in the experiment. In the first series, atropine was given alone at doses of 0.00625 0.0125, 0.025, 0.05, 0.10, 0.20, and 0.40 mg/kg. In the second series mevinphos was given alone at doses of 0.05, 0.10, 0.20, and 0.40 mg/kg. In the third series atropine and mevinphos were given together using atropine at doses of 0.0125, 0.025, 0.05, 0.10, 0.20,

0.40, 1.60, and 6.40 mg/kg. The mevinphos given to one pigeon was 0.20 mg/kg while the other received 0.30 mg/kg. When administered singly, each chemical produced a dose-related decrement in responding. The combined exposure to these drugs produced a performance decrement greater than that caused by exposure to each component drug alone. These findings suggest that prophylactic use of atropine may increase the detrimental behavioral effects of organophosphate exposure and that atropine exposure alone may produce serious behavioral deficits.

76-0932. Newbold, C. (Toxic Chem. Wild. Sect., Monks Wood Exp. Stn., Inst. Terrestrial Ecol., Huntingdon, England). **Herbicides in aquatic systems.** *Biol. Conserv.* 7(2): 97-118; 1975. (61 references)

A review of the literature suggests that the use of aquatic herbicides in Great Britain is increasing. The ecological effects of these substances on aquatic ecosystems depend on the type of herbicide applied, the treatment level, and the frequency of application. Short-term chemical and biological effects could involve a reduction in the oxygen content, an increase in carbon dioxide, a lowering of the pH, an increase in bacterial populations, a change in the nutrient status of the water and in plant communities, and a consequent alteration of habitat for the fauna. Long-term ecological effects depend on the degree of habitat destruction, the persistence of the herbicide, resulting in a suppression of renewed plant growth, and the suitability of any colonizing or nonsusceptible plant species in providing a habitat for the fauna. Even within areas of repeated pesticide treatment, however, it is a simple matter to leave selected sites unsprayed, thereby maintaining some biological interest. The characteristics of 12 herbicides are tabulated: diquat, paraquat, dichlobenil, chlorthiamide, terbutryne, dalapon, diuron, asulam, copper sulfate, maleic hydrazide, maleic hydrazide/2,4-D/chlorpropham, and 2,4-D amine, in terms of persistence in mud and water and toxicity to fish and daphnia.

76-0933. Khan, M.; Gassman, M.; Haque, R. (Univ. Illinois-Chicago Circle, Chicago, IL). **Biodegradation of pesticides.** *Chem. Technol.* 6(1): 62-69; 1976. (95 references)

Various detoxifying reactions that come into play in the initial metabolism of a pesticide are oxidations, hydrolyses, dechlorinations, reductions, and ring cleavage. Each is catalyzed by a specific enzyme or group of enzymes. Certain reactions involved in the detoxication of a pesticide may predominate in certain organisms due to variations in their detoxifying systems. The selective toxicity of pesticides depends on the differences in detoxifying systems among the target and nontarget group of organisms. Malathion can be attacked by many enzymes including carboxyesterases, phosphatases, demethylases, and mixed-function oxidases. In insects the mixed-function oxidase forms the more toxic malaoxon from malathion. This enzyme is more active than other detoxifying enzymes in insects, whereas in mammals, the carboxyesterase is the more active and deacylates malathion to nontoxic metabolites. Most organophosphate and carbamate insecticides are readily detoxified by more than one enzyme, and thus their persistence in the environment is very short. The herbicide 2,4-D is nonpersistent in living organisms as it can undergo hydrolysis, dechlorination, decarboxylation, hydroxymethylation, and ring cleavage. Plants decarboxylate it, algae and fungi hydroxylate it, soil bacteria deacylate, dechlorinate, and hydroxylate it,and also cleave the benzene ring. DDT can undergo dehydrochlorination, dechlorination, and hydroxylation. Dehydrochlorination and hydroxylation are common among DDT-resistant insects. However, these processes occur slowly in algae, aquatic invertebrates, birds, and mammals and not at all in fish.

76-0934. Willis, D. E.; Addison, R. F. (Fish. Res. Board Can. Mar. Ecol. Lab., Bedford Inst. Oceanogr., Dartmouth, Nova Scotia, Canada). **Hydroxylation of biphenyl in vitro by tissue preparations of some marine organisms.** *Comp. Gen. Pharmacol.* 5(1): 77-81; 1974. (10 references)

Results of a survey of some marine representatives of several phyla for biphenyl hydroxylation activity in vitro are described. The study showed that biphenyl was metabolized in vitro to 4-hydroxybiphenyl and, to a lesser extent, to 2-hydroxybiphenyl by tissues of *Raja ocellata*, *Salvelinus fontinalis*, *Homarus americanus*, *Gerydon quinquidens*, *Cancer irroratus*, *Mytilus edulis*, and *Asterias vulgaris*, and by zooplankton. The rates of production of 4-hydroxybiphenyl varied widely among the species studied. However, direct comparison of the data is difficult, as some variations in incubation conditions were required for different species. The rates ranged from 400 nmol/g tissue/hr in *Raja ocellata* to about 2 nmol/g tissue/hr in *Asterias vulgaris*. These were generally considerably slower than values reported in the literature for several terrestrial species. Despite the complications in data interpretation, it is suggested that the wide range of 4-hydroxylating activity observed indicates some real differences among species, and that in general higher rates were associated with higher organisms.

76-0935. Banerjee, S.; Kelleher, J. K.; Margulis, L. (Dep. Biol., Wellesley Coll., Wellesley, MA). **The herbicide trifluralin is active against microtubule-based oral morphogenesis in *Stentor coeruleus*.** *Cytobios* 12(47-48): 171-178; 1975. (35 references)

Evidence has been found to support the hypothesis that trifluralin, a herbicide, is a microtubule inhibitor, i.e., a compound which prevents assembly of microtubule protein into microtubules, but is not a competitive inhibitor of colchicine. In the experiments, trifluralin in ethanol was tested on *Stentor coeruleus*. Trifluralin delayed oral band

formation as as exponential function of concentration between 0.2 and μmol/l. From these studies it is suggested that delay or oral regeneration in *Stentor* and achievement of the classical 'C-metaphase' of mitosis simply requires that tubulin be the drug receptor resulting in interference with the normal polymerization. The correlation between specific delay of oral morphogenesis and mitotic arrest is 100% for all drugs tested, thus indicating that *Stentor* provides a useful fast assay for very small amounts of new compounds suspected of having antitubulin activity. A detailed model is presented showing how live stentors overcome the effects of microtubule inhibitors. It is consistent with the concept that tubulin concentration is the rate-limiting step in oral band regeneration for cells in the presence of tubulin binding drugs. The results of this study suggest that trifluralin and its more soluble derivatives be tested for use in cancer chemotherapy.

76-0936. Yacobi, A. (State Univ. NY., Buffalo, NY). **Pharmacokinetics of warfarin.** *Diss. Abstr. Int. B* 36(7): 3402; 1976.

Pronounced intersubject variation in biological half-life, volume of distribution, plasma clearance, and serum and liver protein binding of warfarin is shown in rats. A strong and statistically significant positive correlation between the free fraction of warfarin in serum and a) the elimination rate constant, b) the volume of distribution, c) the plasma clearance, and d) the free fraction of warfarin in liver is also found. Pronounced intersubject variations in the elimination of warfarin, observed under the conditions of this investigation, are related to interindividual differences in protein binding of the drug in serum. The intersubject variation in free fraction of warfarin in serum is not related to differences in serum albumin or total protein concentration. There is no relationship between the elimination rate constant for warfarin and either the normal (pre-warfarin) prothrombin complex activity or the rate constant for decline of this activity when the synthesis of vitamin K-dependent clotting factors is blocked. Acute administration of phenylbutazone has multiple effects on the pharmacokinetics of warfarin in rats. These effects include: decrease of the biological half-life, increase in the volume of distribution, increase of total clearance, increase of the free fraction of the drug in plasma (due to a displacement effect), decrease of the intrinsic clearance, decrease of the prewarfarin prothrombin complex activity and potentiation of the antiocoagulant action of warfarin. Despite a decrease in the intrinsic clearance, the total clearance of warfarin is increased because of a greater effect of phenylbutazone on the free fraction of warfarin in plasma. Enzyme induction of phenobarbital results in a decrease in the biological half-life of warfarin and in an increase in the pre-warfarin prothrombin complex activity but had no effect on the relationship between warfarin concentration in plasma and anticoagulant effect. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 76-1475.)

76-0937. Takade, D. Y. (Univ. California, Riverside, CA). **The inhibition of acetylcholinesterase from various sources by organophosphorus and carbamic acid esters.** *Diss. Abstr. Int. B* 34(7): 3286; 1974.

The inhibition of acetylcholinesterase from various sources by paraoxon and some analogs was investigated. Acetycholinesterase from the housefly (HFAChE) was sensitive to inhibition by paraoxon, ethyl fenitrothion, isopropyl paraoxon, and isopropyl fenitrooxon. Bovine erythrocyte AChE (BAChE) was inhibited more by paraoxon and ethyl fenitrooxon than isopropyl paraoxon and isopropyl fenitrooxon. Honeybee AChE is strongly inhibited by paraoxon and ethyl fenitrooxon as compared to the corresponding isopropyl analogs. An increase in the inhibitor concentration caused a decrease in the observed Aldridge k. Organic solvents increased the rate of hydrolysis of substrates by HFAChE and BAChE. This increase in activity is also seen with increasing salt concentration. First-order plots for inhibition of HFAChE were curved with all four inhibitors tested in the presence of ethanol, n-propanol, n-butanol, n-pentanol, and Triton X100. First-order plots for the other two enzymes were linear but the estimated ke values were quite variable. Regeneration of HFAChE and BAChE inhibited by carbofuran and propoxur was measured by the dilution method and the Sephadex gel filtration method. The two techniques gave different regeneration rate constants. HFAChE appeared to be more sensitive to inhibition by carbamates than BAChE. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-32,728.)

76-0938. Zeakes, S. J. (Kansas State Univ. Manhattan, KS). **I. Primary reaction assay of the antibody response of three species of gallinaceous birds to *Heterakis gallinarum* cuticular antigen. II. Increased susceptibility of bobwhite quail (*Colinus virginianus*) to *Histomonas meleagridis* after exposure to Sevin insecticide.** *Diss. Abstr. Int. B* 35(8): 3753; 1975.

Primary reaction assays were performed using a crude-cuticular antigen preparation from adult *Heterakis gallinarum* with sera from infected chickens, turkeys, and bobwhite quail. The most significant response of hosts to the cuticular antigen preparation occurred at 5 days post-inoculation when the heterakid larvae are in early tissue phase of their life cycles. Results did not definitely indicate whether the antibodies are directed specifically at a cuticular moiety of the parasite or an exsheathing substance inherent in the cuticle and released only during molting. In nature and in the laboratory, bobwhite quail are very resistant to *Histomonas meleagridis* but may be asymptomatic carriers of this protozoan. The second study investigated whether sublethal doses of Sevin (carbaryl) such as might be available in nature would increase the susceptibility of bobwhites to histomoniasis. Quail given heterakid eggs carrying the histomonad but no Sevin developed cecal histomonads but no pathognomonic histomoniasis. Quail given 50 ppm of Sevin (10 ppm/day) showed only slightly

discolored livers. Quail given concomitant and increasing doses of heterakid eggs containing the histomonad and of Sevin (Sevin increasing from 2.5 to 50 ppm) and those given increasing heterakid eggs and 10 ppm/day of Sevin developed pathognomonic histomoniasis resulting in death of 36 and 63%, respectively, of the birds. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 75-2543.)

76-0939. Wheeler, L. A. (Loma Linda Univ., Loma Linda, CA 92354). **Placental transfer, distribution, metabolism, and depression of acetylcholinesterase in fetal and maternal rats after ^{14}C-Zectran, Mesurol, and carbaryl administration.** *Diss. Abstr. Int. B* 34(7): 3399-3400; 1974.

The anticholinesterase pesticides ^{14}C-Zectran (mexacarbate, 1.2 mg/kg), Mesurol (methiocarb, 1 mg/kg), and carbaryl (30 mg/kg) were injected i.p. into pregnant rats 18 or 19 days in gestation. Zectran, Mesurol, and carbaryl were all characterized by rapid placental transfer. At 15 min in most tissues, distribution of the carbamate was complete and elimination was beginning to be observed. Biphasic elimination kinetics were observed in whole fetus and major fetal organs subsequent to maternal injection with all three carbamates. Initially, 30 to 60 min, there is a rapid rate of loss in ^{14}C after which elimination is rather slow. The slower phase of elimination after carbaryl and Zectran administration seems to be related to the blood flow to the particular fetal organ. Amniotic fluid may act as a reservoir for exposure of the fetus to the carbamates. In the in vitro metabolism experiments supernatants (9,000 × g) were fortified with TPN and G-6-P, incubated in air for two hours, ether extracted, and chromatographed to separate and identify metabolites. In fetal brain 12.2% of the ^{14}C-Zectran added to the incubation flask in vitro was *N*-dealkylated to 4-methylamino-3,5-xylyl methylcarbamate (MA). Maternal brain (11.7%) and maternal liver (15.8%) also had significant metabolic activity. In maternal liver, hydroxylation was also observed (13.6%). With Mesurol, sulfoxidation and hydroxylation are important pathways in fetal liver (23.1%) and maternal liver (12.3%). Ether extraction of tissues and the isolation and identification of ^{14}C indicates that at 30 min post-injection Zectran and carbaryl are the major compounds present. Ether extracts of fetal tissues after ^{14}C Mesurol injection contained a significant amount of the sulfoxide (fetal brain = 35.1% and fetal liver = 32.7%). (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-32,159.)

76-0940. Norback, D. H. (Univ. Wisconsin, Madison, WI). **Morphological and biochemical responses of the rat hepatic endoplasmic reticulum to polychlorinated triphenyls and to chlorinated dibenzo-*p*-dioxins.** *Diss. Abstr. Int. B* 34(10): 5045-5046; 1974.

Pathogenesis of alterations following administration of polychlorinated triphenyls (PCTs) as a 1% dietary additive to rats was investigated by sequential observation and correlation of gross alterations in the organism, liver size, hepatic light and electron microscopic changes, and biochemical alterations of the total liver and of the microsomes. An immediate proliferative response of the endoplasmic reticulum (ER) was characterized by increasing hepatic weight, cell size, vesicular smooth ER with the formation of concentric membrane arrays (CMAs), protein, RNA, lipid, and microsomal material with decreasing microsomal cholesterol and RNA and altered microsomal enzyme activities. Administration of octachlorodibenzo-*p*-dioxin, 34 μg per kg, resulted in morphological and biochemical alterations of the microsomes similar to those induced by the PCTs and included smooth ER proliferation, formation of CMAs, and decreased microsomal cholesterol. The formation of CMAs, a proliferative change of the ER following PCT or chlorinated dibenzo-*p*-dioxin administration, was investigated. Parallel cisternae of the rough ER were reorganized into elongated sinuous structures. Numerous annular profiles of paired membranes with attached ribosomes represented cylindrical cisternae of the rough ER. Concentric annuli of membrane pairs were partially circumscribed by lamellae of the rough ER. This reorganization of the rough ER, presence of ribosomes attached to the surface of the CMAs, and the continuity of these arrays with the ER led to the conclusion that the formations originate from cisternal elements. Evidence was presented for the association of the lowered microsomal cholesterol with the formation of CMAs. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-30,336.)

76-0941. Abdalla, N. A. (Univ. California, Davis, CA). **Distribution, persistence and nematicidal activity of monobromomethane and a pesticide containing 1,3-dichloropropene in soil.** *Diss. Abstr. Int. B* 35(1): 296; 1974.

The behavior in soil of two soil fumigants, monobromoethane (methyl bromide) and a pesticide containing 1,3-dichloropropene (Telone), were studied in laboratory and field situations. Soil type was found to be an important factor affecting diffusion. Methyl bromide in the vapor phase diffused more rapidly and at higher concentrations in a loamy sand than in a sandy clay or silty loam. Methyl bromide diffusion through three soil types (sandy clay loam, silty loam, and loamy sand) was decreased when the soils' moistures were near saturation (92-95% of the soil moisture equivalent). Gravity influences methyl bromide diffusion through soil. Methyl bromide gas was detected in higher concentrations below the point of injection in soil columns than above. In field plot experiments, Telone was applied at rates of 2337.3, 1636, 1402.4, and 1308.8 l/hectare to replant vineyard soils. The fumigant was applied as one application or as split-depth applications. The method of application did not show marked effects on the diffusion pattern of Telone gas in soil. Methyl bromide was applied with and without polyethylene covers at rates of 336.9, 449.1, 561.2, 673.3, and 898.1 kg/hectare to re-

plant vineyard soils to control plant parasitic nematodes. Distribution of the fumigant in the vapor phase in the soil atmosphere at different depths was detected by gas chromatography. Higher doses, low soil moisture, and deeper placement of methyl bromide resulted in more rapid soil penetration and higher concentrations of the gas at the deeper soil levels. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-16,240).

76-0942. Warlen, S. M. (North Carolina State Univ., Raleigh, NC). **Accumulation and retention of DDT by Atlantic menhaden, *Brevoortia tryannus*.** *Diss. Abstr. Int. B* 36(7): 327; 1976.

DDT (and its metabolites DDD and DDE) and dieldrin were measured in young-of-the-year menhaden sampled during their residency in the Newport River estuary in North Carolina. Water, bottom sediment, and seston were concurrently sampled to determine the source of residues to menhaden. Detectable concentrations of DDT and dieldrin were not found in centrifuged water and only trace amounts of DDT were present in the sediments. DDT and dieldrin were detected consistently in all life stages of menhaden and in their food, the seston. It is inferred that the diet is the principal source of DDT and dieldrin residues to menhaden in the Newport River estuary. Menhaden concentrate DDT and dieldrin throughout their residency in the estuary and their body burdens (concentration × dry weight) of these compounds increased substantially. In the laboratory, uptake of ^{14}C-DDT was dose dependent and a function of exposure time. Prediction equations are given for ^{14}C-DDT uptake by menhaden for each of three dose levels and all the data is summarized in response surface diagrams. Menhaden assimilated and retained a mean percent of 17 to 27 of the cumulative dosages of ^{14}C-DDT. The biological half-life of ^{14}C-DDT in menhaden was estimated to be 77, 64, and 109 days respectively in the low, medium, and high dose groups. Exposure to dietary ^{14}C-DDT did not produce any effect on growth of menhaden nor did starvation significantly affect their retention of ^{14}C-DDT. ^{14}C-DDT uptake and retention in the liver, skin, muscle, mesenteric fat, and gut of juvenile menhaden was measured in a final experiment. Mesenteric fat had the greatest concentration of ^{14}C-DDT followed in descending order by gut, liver, muscle, and skin; the degree of ^{14}C-DDT retention was also of the same order. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 76-898.)

76-0943. Hsiung, K. P. (Univ. New Orleans, New Orleans, LA). **Enzymatic detoxification of carbamate insecticides.** *Diss. Abstr. Int. B* 36(7): 3341; 1976.

Carbamates were the latest pesticides to be introduced into the market. Their relatively low persistance and low mammal toxicity make them preferable to other pesticides. The detoxification of the *N*-methyl carbamate insecticides has been studied by an economical, reliable enzymatic approach. The enzyme was isolated from a soil microorganism, *P. striata*, the substrate specificity being genetically manipulated through substrate induction. The enzymatic degradation of Baygon (propoxur) and carbaryl were verified qualitatively by thin-layer chromatography and polyacrylamide-gel disc electrophoresis. The degradation of carbaryl was studied quantitatively via a fluorescence method. A newly developed air-gap electrode was adapted to monitor the response to methyl amine for the assay of the enzymatic degradation of Baygon. The characteristics of this air-gap electrode designed for methyl were thoroughly studied. The detection limit is 12.5 μM. The purification of the crude extract was completed and the intrinsic nature and properties of this enzyme were studied. From a Lineweaver Burke plot, the Michaelis-Menten constant *K*m, was determined to be 6.7 mmole/liter, and the maximum velocity, *V*max, was found to be 2.4 mmole/min. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 75-23,107).

76-0944. Aprikyan, G. V.; Shiginyan, V. A.; Bunyatyan, G. G. (Inst. Biochem., Acad. Sci. Armenian SSR, USSR). **Vliyanie rotenona i vitamina K_3 na okislitel'noe deaminirovanie glutaminovoy kisloty v mitokhondrial'noy fraktsii pecheni belykh krys. [Effect of rotenone and vitamin K_3 on the oxidative deamination of glutamic acid in the mitochondrial fraction of the liver in albino rats.]** *Dokl. Akad. Nauk. Arm. SSR* 61(1): 54-59; 1975. (14 references) (Russian)

The effect of rotenone and vitamin K_3 on the oxidative deamination of glutamic acid in the mitochondrial fraction of rat liver was studied in in vitro experiments. Sharp inhibition of the endogenous respiration by rotenone was observed. It totally inhibited the respiration in the presence of malonate. Rotenone inhibited the oxidation of pyridine nucleotide coenzymes. This inhibition of the oxidation and deamination of glutamic acid by rotenone was suppressed by vitamin K_3.

76-0945. Krieger, R. I.; Gee, S. J.; Miller, J. L.; Thongsinthusak, T. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616). **Monooxygenase-catalyzed aldrin epoxidation and dihydroisodrin hydroxylation in monkey liver needle-biopsy specimens. Assay and properties.** *Drug Metab. Dispos.* 4(1): 28-34; 1976. (21 references)

The epoxidation of aldrin and hydroxylation of dihydroisodrin were studied in 0.2 ml liver monooxygenase preparations. The primary enzyme sources were liver biopsy specimens of rhesus (*Macaca mulatta*) and bonnet (*M. radiata*) obtained with a 1.9 mm Menghini needle. The only metabolites detected by electron capture gas-liquid chromatographic analysis of hexane extracts of the incubation media were dieldrin and monohydroxydihydroisodrin. Maximum rates were ob-

tained in the presence of NADPH and oxygen. Both transformations were inhibited by carbon dioxide. The apparent K*m* and V*max* for epoxidation were .012 m*M* aldrin and 210 pmol of dieldrin/mg protein/min. The corresponding values for hyroxylation were .023 m*M* dihydroisodrin and 150 pmol of monohydroxydihydroisodrin/mg protein/min. Aldrin epoxidation and dihydroisodrin hydroxylation activities of rhesus monkey liver biopsy and rat liver specimens were evaluated after phenobarbital treatment. These studies clearly demonstrated that the microassay procedures were sufficiently sensitive to detect barbiturate induction in rats. The feasibility of using animals as their own controls was clearly demonstrated. Reduced variability and animal costs should be two immediate benefits of such procedures.

76-0946. Larsen, R. V.; Born, G. S.; Kessler, W. V.; Shaw, S. M.; Van Sickle, D. C. (Bionucl. Dep., Purdue Univ., West Lafayette, IN 47907). **Placental transfer and teratology of pentachlorophenol in rats.** *Environ. Lett.* 10(2): 121-128; 1975. (9 references)

Experiments were conducted to determine if pentachlorophenol crosses the placental barrier and accumulates in the fetuses in concentrations sufficient to have a teratogenic effect. Pregnant Charles River CD strain rats were given 60 mg/kg of labeled pentachlorophenol on the 15th day of gestation. The animals were sacrificed at 2, 4, 8, 12, 16, 24, or 32 hr after dosing. To examine the possibility of placental transfer, the amounts of pentachlorophenol and/or its labeled metabolites in the maternal blood serum, fetuses, and placentas were determined. The amount in the placentas probably resulted largely from their blood content. The amount in the fetuses remained very low throughout the experiment period. Thus, it was concluded that the amount of pentachlorophenol that crossed the placental barrier was negligible. For teratology studies, rats were given 60 mg/kg pentachlorophenol on days 8, 9, 10, 11, 12, or 13 of gestation. The animals were sacrificed at 20 days of gestation. Significant temperature increases were noted in animals receiving pentachlorophenol on days 8, 9, and 10 of gestation. The weights of the fetuses of the treated animals were significantly lower than those of the controls only on days 9 and 10. The average reduction in weight for animals treated on these days was about 20 and 13%, respectively. There was no significant change in the incidence of fetal resorptions among treated animals. One malformation, a one-fourth size dwarf, was noted in a rat treated on day 8. Three malformations (exencephaly, macrophthalmia, and taillessness) were noted in 3 different rats treated on day 9. In those animals examined, no bone abnormalities were found. The results of these studies suggest that under these conditions pentachlorophenol may be slightly teratogenic. However, as the amount that crosses the placental barrier is so small, it is suggested that the effect is an indirect one resulting from toxicity to the maternal rat.

76-0947. Kolmodin-Hedman, B. (Div. Occup. Med., Dep. Occup. Health, Karolinska Inst., Stockholm, Sweden). **Decreased plasma half-life of phenylbutazone in workers exposed to chlorinated pesticides.** *Eur. J. Clin. Pharmacol.* 5(3): 195-198; 1973. (11 references)

The plasma half-life (PT0.5) of a single p.o. dose of phenylbutazone (5 mg/kg) was investigated in 14 men (aged 26-71 yr) who were occupationally exposed to a mixture of insecticides. The men sprayed a solution containing 4% lindane, 0.1% pyrethrum, and 2.5% malathion. A few of these men had been exposed to DDT between 1955 and 1965, and 3 had also had intermittent expo ure to pentachlorophenol. Protective clothing and masks were not always worn. The frequency of exposure varied from daily to once weekly. The period of employment ranged from 1 to 20 yr. All men had stable plasma cholinesterase values. The exposed workers had significantly higher plasma levels of lindane, but not of DDE and DDT, than did controls. The mean PT0.5 was significantly shorter in subjects exposed to lindane than in non-exposed controls, but there was no relation between the PT0.5 of phenylbutazone and the plasma level of lindane. Neither was there any correlation between the PT0.5 of phenylbutazone and that of antipyrine determined in the same subjects 2 yr earlier. Assuming that the PT0.5 of phenylbutazone can be used as an index of the metabolism of this drug, it is then suggested that the shorter half-lives found in the exposed subjects indicate that the metabolism of this compound can be enhanced by such environmental factors as exposure to chlorinated pesticides.

76-0948. Johnson, D. D.; Wilcox, W. C. (Dep. Pharmacol., Coll. Med., Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada S7N OWO). **Studies on the mechanism of the protective and antidotal actions of diazepam in organophosphate poisoning.** *Eur. J. Pharmacol.* 34(1): 127-132; 1975. (22 references)

The effect of diazepam on soman-induced bradycardia and respiratory depression in rabbits was studied. Rabbits received soman (10 μg/kg i.v., 6 rabbits), diazepam (1 mg/kg, 6 rabbits), or diazepam followed by soman (1 mg/kg, 6 rabbits). Soman produced bradycardia almost immediately and this increased progressively over the 2 hr recording period. The reduction in heart rate was statistically significant at each 30 min interval. The average heart rate over the 2 hr following soman was 83% of the control. Diazepam produced a tachycardia immediately after injection, but the heart rate was within the normal range during the remainder of the 2 hr period. When the rabbits were pretreated with diazepam, soman did not produce a significant bradycardia. In a second experiment the effect of diazepam on respiratory depression resulting from soman was determined in rabbits. Soman (10 μg/kg) produced an immediate decrease in the depth of respiration and/or a decrease in depth followed by a complete inhibition of the Hering-Breuer reflex during the period when the lungs were deflated. Spontaneous recovery did not occur within 30 min. Diazepam did not reverse the respiratory depression, but produced a further impair-

ment of respiration, atropine was less effective in restoring respiration than after soman alone. In rabbits treated only with diazepam, a slight decrease in respiratory rate was noted. In these experiments, pretreatment of the rabbits with atropine blocked or reduced the profound bradycardia that would normally have been produced by soman. The most frequent observation was a modest fall in blood pressure accompanied by a tachycardia. Administration of diazepam following soman produced a further fall in blood pressure. Both the fall in blood pressure following soman and the rise following a subsequent dose of atropine appeared to coincide with the induced changes in respiratory function. The finding that diazepam will prevent soman-induced bradycardia in conscious rabbits is best interpreted as a central action rather than a peripheral antimuscarinic effect. The antidotal and protective effects of diazepam in organophosphate poisoning do not appear to be due to the reversal of respiratory depression. The ability of diazepam to prevent the bradycardia produced by the organophosphate may contribute to its protective and antidotal action.

76-0949. Akkermans, L. M. A.; Van den Bercken, J.; Versluijs-Helder, M. (Inst. Vet. Pharmacol. Toxicol., Univ. Utrecht, Utrecht, The Netherlands). **Excitatory and depressant effects of dieldrin and aldrin-transdiol in the spinal cord of the toad (*Xenopus laevis*).** *Eur. J. Pharmacol.* 34(1): 133-142; 1975. (36 references)

A study was made of the action of the insecticide dieldrin and one of its metabolites, aldrin-transdiol, on the isolated spinal cord of the toad, *Xenopus laevis*. In the first series of experiments, animals were treated with dieldrin in vivo by injection of 35 mg/kg into the dorsal lymph sac. As soon as symptoms of poisoning were demonstrated the spinal cord was isolated. In most spinal cords isolated from dieldrin-treated animals, no alterations of the dorsal and ventral root potentials were observed. In 4 of 15 cases, however, a striking increase was noted in polysynaptic activity. In no case were any significant changes observed in dorsal root potentials elicited by stimulation of either the ventral root of the same segment or the adjacent dorsal root. The direct application of dieldrin to the isolated spinal cord did not produce any significant effect. However, application of aldrin-transdiol caused a potentiation of spinal reflex activity and an increase in spontaneous activity of ventral and dorsal roots. A marked reduction of spinal inhibitory mechanisms was also produced by aldrin-transdiol. The excitatory effects of aldrin-transdiol were followed by a strong depressant action on spinal excitability.

76-0950. Freed, V. H.; Matin, M. A.; Fang, S. C.; Kar, P. P. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331). **Role of striatal dopamine in delayed neurotoxic effects of organophosphorus compounds.** *Eur. J. Pharmacol.* 35(1): 229-232; 1976. (20 references)

Adult male albino rats were used to investigate changes in the cholinesterase activity and dopamine level of the corpus striatum after treatment with organophosphorus compounds. They were injected with mipafox (5 mg/kg), leptophos (10 mg/kg) or fenitrothion (25 mg/kg) s.c. for 35 days. The animals were sacrificed 48 hr after the last injection. As expected the compounds produced marked inhibition of striatal cholinesterase activity. Mipafox also produced marked lowering of the dopamine level of striatum. Leptophos produced a slight but significant reduction in the dopamine level. Fenitrothion did not change the level of striatal dopamine. Mipafox-treated animals developed ataxia during the last 4-5 days of the test period. Slight motor dysfunction consisting of muscle twitchings and fasciculations was noted during the last 2-3 days of the study in animals which had received leptophos. Fenitrothion did not produce any visible delayed neurotoxic effects. The results of this study indicate that inhibition of cholinesterase per se is not responsible for delayed neurotoxic effects of organophosphorus compounds. It is suggested that the neurochemical imbalance produced as a result of inhibition of cholinesterase and reduction of dopamine in the corpus striatum may be partly involved in the delayed neurotoxic effects of certain organophosphorus compounds.

76-0951. Anina, I. A.; Medved', I. L.; Proklina, T. L. (Kiev Sci. Res. Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **K voprosu o gonadotropicheskom deystvii pestitsidov—proizvodnykh tiokarbaminovoy kisloty. [Gonadotoxic action of pesticidal thiocarbamic acid derivatives.]** *Farmakol. Toksikol. (Moscow)* 38(1): 90-93; 1975. (10 references) (Russian)

The gonadotoxic effects of molinate and eptam were studied in 2 mo poisoning tests in sexually immature male rats. The animals were given oral 1/100 LD50 doses of molinate (3.6 mg/kg) and eptam (EPTC) (16.6 mg/kg) until sexual maturation. Reduced motility and viability of the spermatozoa and reduced numbers of spermatozoa were observed in rats treated with molinate. However, there was no reduction in fertility. Increased rates of resorption, increased incidence of disturbances in embryogenesis, and reduced numbers of offspring per litter were observed in intact females mated with molinate-treated males. Also, there was an increased postnatal mortality rate in the offspring. Reduced RNA content, increased RNAase and DNAase activity, reduced tissue respiration, and reduced activity of the cytochrome system were observed in the testicular tissues of molinate-treated animals. Eptam exerted no gonadotoxic effect under the same conditions.

76-0952. Zakirov, U. B.; Kadyrov, U. E.; Volokhvyanskiy, E. A. (Dep. Pharmacol., Tashkent Med. Inst., Tashkent, USSR). **Vliyanie butifosa na fermentoobrazovatel'nuyu funktsiyu tonkogo kishechnika. [Effect of butyphos on the enzymogenic function of the small intestine.]** *Farmakol. Toksikol.(Moscow)* 38(1): 96-99; 1975. (9 references) (Russian)

The effect of butyphos (DEF) on the enzymogenic function of the small intestinal mucosa was studied in albino rats. Doses equaling 1/50, 1/20, 1/5, and 1/3 LD50 (205 mg/kg) were introduced into the stomach of the animals daily for 4-10 mo. Doses of 1/50 and 1/20 LD50, administered for 10 mo, caused a sharp decrease in the monoglyceride lipase activity and fluctuating changes in the phosphatase, dipeptidase, and invertase activities. In animals given 1/5 LD50 for 4 mo, butyphos produced a progressive rise in the activities of alkaline phosphatase, invertase, and amylase, and reduced the monoglyceride lipase activity. Separate tests with 1/3 LD50 doses, in which butyphos could not affect the enzyme production, revealed no difference in the enzyme activities between the test group and the controls. This indicates that butyphos interfered with enzyme production in the cells of the small intestinal mucosa instead of inhibiting or activating the enzymes already produced.

76-0953. Kuz'minskaya, U. A.; Bersan, L. V. (Lab. Biochem., All-Union Sci. Res. Inst. Hyg. Toxicol. Pesticides, Polymers, and Plastic Mater., Kiev, USSR). **Vliyanie natrievoy soli 2,4-dikhlorfenoksiuksusnoy kisloty na glikoliz, aktivnost' ATF-azy i transketolazy eritrotsitov. [Effect of sodium 2,4-dichlorophenoxyacetate on glycolysis and activity of ATPase and transketolase in erythrocytes.]** *Farmakol. Toksikol. (Moscow)* 38(1): 102-104; 1975. (11 references) (Russian)

The effect of single 1 g/kg oral doses and of daily 20 mg/kg doses of 2,4-D sodium salt on glycolysis and on the ATPase and transketolase activities of the erythrocytes were studied in male albino rats. Both the glycolysis and the ATPase and transketolase activities were intensified following the administration of a single 1 g/kg dose, but the values were normalized in 15 days. Reduced intensity of glycolysis, increase in the transketolase activity by 44%, and 160% increase in the ATPase activity were observed in animals fed daily 20 mg/kg doses for 3 mo. While the glycolysis and ATPase nearly normalized, the transketolase activity remained low after poisoning with the same dose for 6 mo.

76-0954. Hatcher, V. B.; Levine, N.; Lazarus, G. S. (Albert Einstein Coll. Med., Montefiore Hosp., Bronx, NY 10467). **Characterization of the neutral proteinases extracted from human skin.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 34(3): 484; 1975.

A highly sensitive radioactive method has permitted the identification of three neutral proteinases in human skin. The proteolytic activity was assayed by measuring the production of TCA soluble ^{3}H-peptides from acetylated ^{3}H-casein (2970 cpm/pmol) or ^{3}H-hemoglobin (460 cpm/pmol). Tissue proteinases were extracted from human skin, utilizing 0.05 *M* sodium phosphate buffer pH 7.5 containing 0.1% Triton X-100 and 1.0 *M* KCl. Whole human skin, separated epidermis, and separated dermal connective tissue contained at least three neutral proteinases which were inhibited by diisopropylfluorophosphate (DFP). Further purification of the enzymes was performed utilizing ammonium sulphate precipitation, Sephadex G-75 and Sepharose 4B gel filtration, and DE-52 cellulose chromatography. Treatment of the serine preteinase with ^{3}H-DFP followed by SDS polyacrylamide gel electrophoresis indicated that the molecular weight of the three neutral proteinases ranged from 10 to 40 daltons. In addition, there was a large molecular weight aggregate of proteolytic activity. (Abstract no. 1485 from the 59th annual meeting of the FASEB, reprinted by permission)

76-0955. Smith, R. J. (Tulane Univ., Sch. Med., New Orleans, LA 70112). **Renal hydrolase activity and erythropoietin production.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 34(3): 804; 1975.

The biogenesis of erythropoietin (ESF) purportedly involves the interaction of a renal enzyme(s), which is released into the circulation, and a circulating protein precursor (erythropoietinogen). It has been demonstrated that this renal erythrogenic activity is localized in the light mitochondrial fraction (LMP) and has been designated the renal erythropoietic factor (REF). We have demonstrated that the erythropoietic stimulant, cobaltous chloride-hexahydrate (250 μ moles/kg, s.c.), caused labilization of renal lysosomes (in the LMF), which contain the majority of intracellular hydrolases. We report here that REF activity in vitro is inhibited by trasylol, DFP, 3 mercaptopropionic acid and 2-mercaptoethanol. REF appears, therefore, to be a neutral pH acting proteolytic serine esterase with metalloenzyme requirements. In addition, plasma neutral protease activity was elevated in rats at 1(50%), 4(90%), 8(200%), and 12(60%) hrs following cobalt administration. REF activity and plasma ESF levels reached a maximum between 8 and 12 hours post-cobalt. Plasma levels of lysosomal marker enzymes were also elevated during these time intervals. These observations would seem to implicate renal enzymes in ESF production. (Abstract no. 3308 from the 59th annual meeting of the FASEB, reprinted by permission)

76-0956. Soberano, M. E.; Ong, E. B.; Johnson, A. J.; Schoellmann, G.; Levy, M. (New York Univ. Med. Cent., New York, NY 10016). **Inhibition of studies of urokinase with diispropylphosphorofluoridate (DFP) and *p*-nitrophenyl-*p'*-guanidinobenzoate (NPGB).** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 34(3): 860; 1975.

Heterogeneity of highly purified urokinase (UK) preparations (80,000 CTA units/mg protein) was seen on: acrylamide gel electrophoresis (AGE) at pH 4.3 (3 components), isolectric focusing-AGE (6 components), sodium dodecyl sulfate-AGE (SDS-AGE) (5 components), and NH_2-terminal analysis (5 NH_2-terminals). NPGB proved to be an effective active-site titrant for UK; when UK was reacted with it or DFP, inhibition was shown by the purified protamine or caseinolytic assay. Cross-titrating UK with ^{3}H-DFP and NPGB showed nearly stoichiomet-

ric incorporation of ^{3}H-DIP into UK by a concomitant decrease in active sites and in enzymatic activity. SDS-AGE of ^{3}H-DIP-UK showed the label in the 48,000 and 33,000 M.W. bands of the unreduced sample, and the 33,000 M.W. band only of the reduced sample. The molecular weights of the bands containing the active site were confirmed by using ^{14}C-NPGB. The 48,000 and 33,000 M.W. fractions were resolved with Sepharose-epsilon amino caproyl-agmatine affinity columns. On DSS-AGE, the reduced 48,000 M.W. fraction (^{3}H-DFP-treated) showed radioactivity in the 33,000 but not in the 18,000 M.W. band. The results suggest that UK is a serine protease and the essential serine residue is in the heavy chain. (Abstract no. 3629 from the 59th annual meeting of the FASEB, reprinted by permission)

76-0957. Koschier, F. J.; Berndt, W. O. (Dep. Pharmacol. Toxicol., Univ. Mississippi Med. Cent., Jackson, MS 39216). **The effect of 2,4,5-trichlorophenoxyacetic acid on tetraethylammonium accumulation by rat renal cortical slices.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 224; 1976.

Previous studies have shown that the acute pretreatment of rats with 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) reduces the renal transport of tetraethylammonium (TEA) by 25%. This study was performed to determine whether or not the residual 2,4,5-T in the kidney cortex was responsible for this inhibition. Renal cortical slices were preloaded with 2,4,5-T to a concentration similar to that found in the pretreatment experiments and then uptake of radiolabeled TEA was measured. The tissue preincubated with 2,4,5-T showed a 20% decrease in the accumulation of TEA as compared to control tissue preincubated without 2,4,5-T. Additionally, the 120 min uptake of TEA was decreased when the tissues were incubated with 2,4,5-T simultaneously. Further, the depression was greater the higher the 2,4,5-T concentration. When the incubation time was reduced from 120 min to 5 min the inhibition of TEA uptake was reduced from an average of 34% to 7%. Furthermore, a negligible (0.4%) inhibition of TEA accumulation was caused by 2,4,5-T when the incubation time was reduced to 2 min. The results are interpreted to mean that 2,4,5-T has minimal, if any, effect on TEA transcellular transport but reduces the intracellular accumulation of TEA as 2,4,5-T is concentrated in the renal cortex. (Abstract no. 95 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0958. Guenthner, T. M.; Poland, A. P.; Nebert, D. W. (NICHD, Natl. Inst. Health, Bethesda, MD 20014). **Evidence for possible receptors active in aryl hydrocarbon hydroxylase induction in established cell lines by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 282; 1976.

Previous studies showed a 10,000-fold difference in the responsiveness of aryl hydrocarbon (benzo[a]pyrene) hydroxylase (AHH) induction to 2,3,7,8-tetrachlordibenzo-*p*-dioxin (TCDD) among ten established cell lines. Using a radiometric assay for specific binding of [^{3}H]TCDD to cytosol protein, we hoped to determine whether the observed differences in AHH inducibility might be attributed to differences in the number or the affinity of receptor sites. Results indicate the presence of a soluble saturable high affinity binding protein which may act as a receptor in the initial step of AHH induction by TCDD. The apparent *K*d for TCDD (0.5-10. n*M*) in TCDD-"responsive" Hepa-1 and Reuber H-4 lines compared favorably with the LD50 for AHH induction (0.23-0.45 n*M*). The apparent *K*d in TCDD-"nonresponsive" HTC and VERO lines (1.5-2.0 n*M*), on the other hand, was much less than the ED50 for AHH induction (100-+200 n*M*), indicating that the inability of these lines to respond to induction by TCDD reflects some defect other than an absence of soluble binding sites. Radiolabeled TCDD was displaced from these sites by nonlabeled TCDD but not by high concentrations of analogs which are ineffective in inducing AHH activity. (Abstract no. 422 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0959. Roper, M.; Stock, T.; Deitrich, R. A. (Univ. Colorado, Sch. Med., Denver, CO 80220). **Phenobarbital and tetrachlorodibenzo-*p*-dioxin induce different isoenzymes of aldehyde dehydrogenase.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 282; 1976.

Rat liver supernatant aldehyde dehydrogenase activity (I) is greatly inducible by phenobarbital (ϕ) in one genetically selected line of rats (RR) but induced activity is not detected in another line (rr). This enzyme (I-ϕ) has been highly purified, and monospecific antisera have been prepared against it. The induction of I-ϕ has been shown both through Ouchterlony and complement fixation techniques to result from the accumulation of enzyme protein. The complement fixation technique also revealed a small increase in I-ϕ protein in the rr line of rats treated with phenobarbital. Preliminary experiments indicate that the rate of I-ϕ protein synthesis in RR rats is increased following phenobarbial administration. In contrast to phenobarbital, it has been found that 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) will also induce aldehyde dehydrogenase activity (I-ϕ) in either line of rats (RR or rr). Anti-I-ϕ-serum (directed against I-ϕ) does not cross-react with I-T. In addition, the molecular weights of the two enzymes differ by at least two-fold. It is therefore concluded that I-ϕ and I-τ are separate proteins which catalyze the oxidation of propionaldehyde and whose activities are regulated differently. (Abstract no. 424 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0960. Strother, A.; Wheeler, L.* (Harvard Sch. Med., Boston, MA 02215). **Disposition of ^{14}C-carbaryl in pregnant, nonpregnant and fetal tissues of the rat.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 327; 1976.

Nonpregnant (NP) and pregnant (P) rats on the 18th to 19th days of gestation were injected with a dose of either ring-^{14}C-labeled (RC) or carbonyl-^{14}C-labeled (CC) carbaryl. Distribution of ^{14}C was examined in fetal, maternal, and nonpregnant tissues. ^{14}C-carbaryl rapidly crossed the placenta and distributed into all fetal tissues. Fetal brain, heart, and lung contained more ^{14}C on a weight basis than maternal counterparts, 8 hr post-injection. After 8 hrs about 3% of the dose was in the fetus. The p rats exhaled significantly more $^{14}CO_2$ than the NP after 8 hrs indicating that pregnancy possibly increased the hydrolytic activity. However, the P rats excreted less of the ^{14}C of RC in the urine than the NP rats. Kinetically, tissue distribution of the ^{14}C-carbaryl (or metabolites) was biphasic in both P and NP. ^{14}C declined rapidly for 1 to 2 hr but the second phase in RC treated animals declined slower. The ^{14}C-pattern of distribution of CC was more complicated as the ^{14}C-activity in tissues of CC treated animals began to increase after 2 hrs. This may indicate carbamylation of tissue proteins. (Abstract no. 677 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0961. Pritchard, J. B.; Kaemmerlen, R. W.; Wolfe, D. A. (Med. Univ. South Carolina, Charleston, SC 29401). **Role of the kidney in excretion of DDT and metabolites by the rat.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 327; 1976.

The major form of DDT excreted by most vertebrates is DNA [2,2-bis (*p*-chlorophenyl) acetic acid]. Recently flounder kidney was shown to secrete DDA via the organic acid transport system. The importance of this mechanism in mammalian DDA excretion was examined in the rat using cortical slices in vitro and renal clearance techniques in vivo. Cortical slices accumulated ^{14}C-DDA to levels 25-30 times medium concentration (10 μM) in 60 min. Efflux studies demonstrated that while much intracellular DDA was bound, the free DDA concentration was 2-3 times uptake medium concentration. Thus, uptake occurred against a concentration gradient. Metabolic inhibitors reduced uptake 50%. Organic acids inhibited 50-100% of the energy dependent uptake. However, in the rat, unlike the fish, even correcting for extensive plasma DDA binding (98%), renal DDA clearance was only 10-30% of the filtration rate. Thus, DDA was reabsorbed by the rat kidney. Mersalyl increased DDA clearance and excretion approximately 40%. Unfortunately, due to the heavy plasma binding, even in the presence of mersalyl less than 1% of the DDA reaching the kidney was excreted. (Abstract no. 678 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0962. Giri, S. N.; Gribble, D. H.*; Peoples, S. A. (Dep. Physiol. Sci. and Pathol., Univ. California, Davis, CA 95616). **Distribution and binding of radioactivity in the starling after i.v. administration of [^{14}C] 3-chloro-*p*-toluidine.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 328; 1976.

Ring labeled avicide [^{14}C] 3-chloro-*p*-toluidine (CPT) was injected (14.7 μc) i.v. to starlings. The radioactivity (RA) was found to be unevenly distributed in different tissues. The retention half-life of RA in brain, spleen, heart, and bone marrow was similar to plasma (3-6 hr). Longer RA retention (8-15 hr) was found in muscle, lung, liver and kidney. Of the nine tissues examined, a substantial amount of ^{14}C-CPT RA was found covalently bound only to liver and kidney proteins. The extent of covalent binding to kidney protein always exceeded the binding to liver protein. Microscopic examination of liver and kidney sections prepared from birds 12 hours after ^{14}C-CPT injection revealed marked hepatic necrosis and hyaline granularity of the renal cytoplasm. Pretreatment of birds with phenobarbital or tissue glutathione depletor diethylameate had no effect on covalent binding of ^{14}C-CPT RA to liver protein. These pretreatments, however, significantly enhanced the binding to kidney protein without producing any significant effect on kidney pathology. In contrast to kidney, SKF 525A in phenobarbital pretreated birds had a marked inhibitory effect on covalent binding of ^{14}C-CPT to liver protein. A disparity between the extent of covalent binding and tissue lesion was noted in this study. (Abstract no. 683 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0963. Davison, K. L. (Metab. Radiat. Res. Lab., Agric. Res. Stn., U.S. Dep. Agric., Fargo, ND 58102). **Methoprene-^{14}C metabolism in chickens: distribution and elimination of the radioactivity.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 328; 1976.

Methoprene (isopropyl (2*E*,4*E*)-11- methoxy-3,7,11-trimethyl- 2,4-dodecadienoate) is a synthetic insect growth regulator that mimics the physiological action of insect juvenile hormone. As a feed-through larvicide, methoprene prevents the development of houseflies in poultry manures. When about 4 mg of methoprene-5-^{14}C was given in a single dose of colostomized chickens, elimination of carbon-14 was greatest in exhaled air; however, when 105 or 107 mg of methoprene was given, elimination of carbon-14 was greatest in urine. Up to 19% of the carbon-14 from a single dose of methoprene was eliminated over a 14-day period in the eggs of laying hens, and carbon-14 was detected in all tissues and organs examined. (Abstract no. 684 from the 60th annual meeting of FASEB, Aneheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0964. Yarbrough, J. D.; Watkins, J. H. (Dep. Zool., Mississippi State Univ., Mississippi State, MS 39762). **Aldrin and dieldrin metabolism in insecticide-resistant and susceptible mosquitofish (*Gambusia affinis*).** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 375; 1976.

Insecticide-resistant and susceptible mosquitofish (*Gambusia affinis*) were exposed to 30 ppb ^{14}C-dieldrin and 80 ppb ^{14}C-aldrin. The concentrations of each insecticide and their metabolites were determined in both resis-

tant and susceptible fish liver tissue after 6 hr of insecticide exposure. There were no significant differences in either dieldrin or metabolite(s) between resistant and susceptible mosquitofish. However, resistant fish appeared to metabolize aldrin directly to a water soluble complex without forming dieldrin as an intermediate. This ability is either lacking or greatly reduced in susceptible mosquitofish. Aldrin metabolism without the formation of dieldrin as an epoxidation product has not been previously reported, and represents an effective pathway for the detoxication of a reduced chlorinated cyclodiene. (Abstract no. 933 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0965. Mehendale, H. M. (Univ. Mississippi Med. Cent., Jackson, MS 39216). **Mirex induced suppression of biliary excretion of PCB's.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 375; 1976.

Effects of pretreatment with mirex (50 mg/kg/day, p.o., 5 days), phenobarbital (PB) (100 mg/kg/day, i.p., 3 days), and 2,4,5-2′,4′,5′-hexachlorobiphenyl (6-CB) (50 mg/kg/day, i.p., 3 days) on the biliary excretion of ^{14}C-4-chlorobiphenyl (1-CB) and 6-CB was investigated using isolated perfused rat liver preparations (IPL) obtained from treated and control animals. Pre-exposure to mirex caused a suppression (+ 90%) of the biliary excretion of ^{14}C from 1-CB and 6-CB. This effect appears to be unrelated either to the decreased rate of metabolism or to the rate of bile flow since the excretion of added metabolites of 1-CB was also suppressed (+ 85%) in the IPL from mirex treated animals. Increased bile flow was attendant with the suppression of biliary excretion of the PCBs. Pre-exposure of the animals to PB or 6-CB caused modest increases in the biliary excretion of ^{14}C from 1-CB accompanied by slight increases in the bile flow. The biliary excretion of 6-CB was completely suppressed by mirex whereas PB was without any effect. These results suggest that the mirex effect is located at the site of the transfer of 1-CB metabolites from the hepatocytes to the bile canaliculi. (Abstract no. 934 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0966. Chambers, J. E. (Mississippi State Univ., Mississippi State, MS 39762). **Induction of mixed-function oxidase activity by DDT in the mosquitofish.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 375; 1976.

An organochlorine-insecticide resistant population of mosquitofish, *Gambusia affinis*, possesses greater mixed-function oxidase activity than a corresponding susceptible population with respect to metabolism of such xenobiotics as aldrin and parathion. Induction of mixed-function oxidase activity by environmental factors has been suggested. The effect of DDT exposure on several hepatic microsomal electron transport components in susceptible and resistant mosquitofish was investigated. Fish were continuously exposed to sublethal concentrations of DDT for one week. Those hepatic components studied were: NADH- and NADPH-cytochrome *c* reductases, NADPH-dichlorophenolindophenol reductase, NADPH-cytochrome b5 reductase, cytochrome *b*5 and P-450, and total and microsomal protein. Although all tests were not positive, several DDT exposures resulted in about two-fold increases in levels of some of the observed parameters. Total hepatic protein contents was not altered. Microsomal protein was increased 60%. All electron transport components studied were inducible. Dramatic increases in levels seen on a wet weight or total protein basis were not reflected on a microsomal protein basis since microsomal protein and electron transport components were increasing concomitantly. In some cases, induction of the cytochromes preceded that of the enzymes. Inherent activity levels were greater in the resistant fish. (Abstract no. 935 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0967. Kupfer, D.; Bulger, W. H. (Worcester Foundation Exp. Biol., Shrewsbury, MA 01545). **Inhibition by carbon tetrachloride of the *o,p′*-DDT and estradiol (E_2)-mediated induction of rat uterus ornithine decarboxylase (ODC).** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 375; 1976.

The observation that the administration of CC14 to female rats potentiates the uterotropic activity of E_2 and diminishes this action by *o,p′*-DDT was due to a metabolite of *o,p′*-DDT. In an attempt to further investigate this possibility we examined the effect of CC14 on another "estrogenic" activity of *o,p′*-DDT and E_2; i.e., induction of ODC by these compounds. Ovariectomized rats were given corn oil orally or 0.67 ml CCl_4 (in corn oil)/kg B.W. After 18 and 19 hours, the rats were injected with *o,p′*-DDT (10 mg) or E_2 (0.07 μg) in corn oil, respectively. Six hours after *o,p′*-DDT or 5 hours after E_2 uteri from 3-4 rats were pooled and 20,000 g cytosol was assayed. Results demonstrated that CCl_4 inhibited the induction of ODC by *o,p′*-DDT and E_2 (units pmol $^{14}CO_2$ evolved per hour per mg protein). DDC levels in animals given corn oil alone averaged 16.7 units; animals that received CCl_4 had values of 3.9, thus 81% inhibition. Administration of *o,p′*-DDT resulted in values of 1410 units in corn oil-pretreated animals and 858 units in animals pretreated with CCl_4, thus a 39% inhibition of induction. Induction was inhibited by 61% in estradiol-treated animals pretreated with carbon tetrachloride. Since both E_2 and *o,p′*-DDT is probably not due to interference with the metabolism of *o,p′*-DDT. In a separate experiment it was demonstrated that the cytosolic estrogen receptor (number of binding sites) was not affected by CCl_4. (Abstract no. 936 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0968. Moslen, M. T.; Reynolds, E. S.; Szabo, S. (Peter Bent Brigham Hosp., Boston, MA 02115). **Correlations between the chemically induced potentiation of trichloroethylene hepatotoxicity and its metabolism.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 375; 1976.

Trichloroethylene (TRI) is metabolized by the mixed function oxidase system (MFOS) of liver endoplasmic reticulum (ER). It was demonstrated that both the metabolism and hepatotoxicity of TRI can be enhanced by induction of the MFOS. Male rats (200 g) were pretreated with 400 μmoles/kg/day of phenobarbital (PBT), 3-methylcholanthrene (3-MC), hexachlorobenzene (HCB), pregnenolone-16 α-carbonitrile (PCN), spironolactone (SNL), 150 μmoles/kg of Aroclor 1254 (A-1254), or the vehicle p.o. for 7 days, then fasted overnight and exposed to TRI (1% × 2 hr), air, or sacrificed to verify differential induction of MFOS components. 24 hr after TRI exposure, morphologic injury and elevated serum transaminase (SGOT) were found in PBT and A-1254, to a lesser extent in HCB, PCN and 3-MC, but were not apparent in the SNL and vehicle animals. Extent of injury as determined by SGOT elevations appears directly related to prolongation of anesthesia recovery time, increased urinary excretion of trichlorinated metabolites and the mean magnitude of induction of cytochrome P-450. Focusing on TRI hepatotoxicity in PBT animals, we have found that the ER appears primarily involved. Reduced glutathione is moderately decreased by TRI exposure, but recovers within hours before hepatocellular injury becomes overtly manifest. (Abstract no. 938 from the 60th annual meeting, of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0969. Berry, D. L.; Zachariah, P. K.; Slaga, T. J.; Juchau, M. R. (Dep. Pharmacol. and Anesthesiol., Univ. Washington, Seattle, WA). **Transplacental stimulation of benzo[a]pyrene (BP) metabolism in extrahepatic tissues by 2,3,7,8-tetrachlorodibenzo-*p*-dioxon (TCDD).** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 409; 1976.

The effects of the highly toxic herbicide contaminant TCDD (2.5 μg/kg, i.p.) were studied in fetal livers, lungs and skin, placentas and maternal livers, lungs, and adrenal glands of Sprague-Dawley rats. Aryl hydrocarbon hydroxylase activities were increased 14- and 100-fold in maternal and fetal lungs, 30-fold in fetal skin, but only minimally in placentas and adrenal glands. Analyses of BP metabolism with high pressure liquid chromatography showed that maternal livers produced large quantities of several metabolites that were more polar than the dihydrodiols. Ratios of diols/phenols were highest in fetal lungs > maternal livers > fetal livers > maternal lungs > fetal skin > placentas. Epoxide hydrase activity was investigated with BP-4,5-oxide as substrate. The specific activities were highest in the maternal liver > fetal liver > maternal lung > fetal lung > fetal skin. The capacity of the various tissues to catalyze covalent binding of BP to DNA in vitro correlated well with theoretical expectations regarding the relative activities of the enzyme systems investigated. (Abstract no. 1125 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0970. Story, D. L.; Russel, P. E.; Freedland, R. A. (Dep. Physiol. Sci., Univ. California, Davis, CA 95616). **Effects of feeding DDT on gluconeogenesis in rat liver.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 504; 1976.

Gluconeognesis from 10 m*M* lactate is decreased in in situ perfused livers from rats fed DDT. Studies using isolated rat hepatocytes were done to determine if hormonal or fatty acid stimulation of gluconeogenesis from lactate is altered by DDT feeding and if gluconeogenesis from other substrates is affected by DDT feeding. Hepatocytes were isolated from rats fed either chow or chow supplemented with 1000 ppm *o,p*-DDT for 12 days. All rats were fasted for 48 hours prior to cell isolations. Cells were incubated for one hour with 9 m*M* lactate:1 m*M* pyruvate (L:P), L:P plus 2 m*M* butyrate, L:P plus 50 μ*M* glucagon, 10 m*M* L-alanine, or 10 m*M* glycerol. Gluconeogenesis from L:P was decreased by 25% in hepatocytes from rats fed DDT; however, the rates of gluconeogenesis from alanine and glycerol were not affected by DDT feeding. The stimulation of gluconeogenesis from L:P by glucagon or butyrate was similar in rats fed DDT and control rats, although the absolute rates of gluconeogenesis were lower in the rats fed DDT. This data suggests that DDT affects gluconeogenesis between pyruvate and the triosphosphates. (Abstract no. 1646 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0971. Obersteiner, E. J.; Sharma, R. P. (Toxicol. Program, Vet. Sci. Dep., Utah State Univ., Logan, UT 84322). **Cytotoxicity of selected organophosphates in chick ganglia cell cultures.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 504; 1976.

The sympathetic ganglia from chick embryo were used as a model to study the relative neurotoxic properties of both esterase inhibitory and non-inhibitory organophosphates. Ten-day-old ganglionic explants were cultured for 72-hr incubation periods in a suitable medium containing variable concentration of organophosphorus compounds in microslides at 37°C and were examined by phase and light microscopy for abnormalities in the growth pattern, cellular constituents, and densities of nerve fibers, glial cells, and neurons. Concentrations to produce half maximal effect ranged from 10 μ*M* (severely toxic) for paraoxon, methylparathion, mevinphos, and diazinon; to approximately 1 m*M* (intermediate) for diisopropylfluorophosphate, tri-*o*-tolyl phosphate, malathion, and leptophos, while some or no effects at 10 m*M* were evident for EPN, chlorpyriphos and triphenyl phosphate (TPP). In all instances nerve fibers were more sensitive to the insecticides than were neurons and glial cells. All cellular growth was inhibited at 10 m*M* (except for TRP); no inhibitory effects were evident below 1 μ*M*. Among the secondary abnormalities were decreased cellular migration, diffuse cellular growth pattern, decreased ganglionic differentiation, increased vacuolization, and cellular degeneration. The potential usefulness of such tissue culture model in screening relative neurotoxicities of insecticides and to elucidate their mechanisms may be given consideration. (Abstract no. 1648 from the 60th annual meeting of

FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0972. Reddy, K.; Omay , S.; Chiu, M.; Litov, R.; Hasegawa, G.; Cross, C. (Calif. Primate Res. Cent., Univ. California, Davis, CA 95616). **Biochemical effects of antiinflammatory agents (AA) on the survival of rats in acute paraquat (PQ) toxicity.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 505; 1976.

Rats were treated (p.o.) daily for 5 days with either aspirin (ASA), indomethacin (IMD), hydrocortisone (HYC), or 0.25% agar (control). Lung tissues were assayed for biochemical changes and the results were expressed on a per lung basis as % over control values. Following drug pretreatments, cytosolic superoxide dismutase (SOD), glutathione peroxidase (GP) and glutathione reductase (GR) activities and total nonprotein sulfhydryls were elevated 30-70%, 5-25%, and 5-30%, respectively. In a second experiment rats pretreated as above were injected (i.p.) on the 5th day with PQ (29 mg/kg). All agar-treated control rats died within 48 hrs after PQ injection. In rats pretreated with ASA, IND, or HYC, survival rates of 13-18%, 31-80%, and 47-63%, respectively, were observed. Control rats expired more ethane after PQ injection. PQ injection resulted in marked elevations of SOD (82%), GP (328%), and GR (36%) in the lungs of PQ-injected control rats over non-PQ injected controls. Elevation of these enzymes was also noted in drug-treated rats after PQ injection but at values significantly less than PQ-injected controls. Increases in enzyme activities and ethane evolution supports the hypothesis that O_2 and lipid peroxidation may have roles in PQ-induced lung damage. The biochemical changes produced by AA suggest a significant augmentation of the lung protective capabilities against O_2 and hydroperoxide-induced lung damage. (Abstract no. 1656 from the 60th annual meeting, of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0973. Lovett, E. J.; Lundy, J. (Univ. Connecticut Health Cent., Farmington, CT 06032). **Immunomodulating effects of thiabendazole on murine spleen cells.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 532; 1976.

The object of this study is to determine the effect of thiabendazole (TBZ), 2-(4-thiazolyl) benzimidazole, on the blastogenic response of spleen cells to mitogens and transplantation antigens. Six to eight week old C57B1/6 mice were given a single i.p. injection of TBZ (20 mg/kg) and single cell spleen suspensions were made at varying times following in vivo treatment. Stimulation indices to PHA, Pokeweed, and Lipopoylsaccharide were 75-100% greater than controls. Optimal response to all mitogens was obtained with cells harvested 24 hours after TBZ administration. In a one-way mixed leukocyte culture (MLC) to irradiated BALB/c stimulator cells, responder cells from TBZ treated C57B1/6 mice had a stimulation index four times greater than control cells. Irradiated TBZ treated C57B1/6 cells were also better stimulators to BALB/c cells than non-treated cells. When TBZ treated C57B1/6 cells were divided into plastic adherent and non-adherent populations and each reconstituted with complementary cells from non-treated controls, reactivity in a one-way MLC was for both populations greater than non-treated control cells. Thiabendazole, or an active metabolite present at 24 hours, can augment the response to T and B cell mitogens. More than one spleen cell population is potentiated by thiabendazole in the MLC. These observations can be explained on the basis of drug induced membrane alterations. (Abstract no. 1797 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0974. Haley, T. J.; Farmer, J. H.* (NCTR, Jefferson, AR 72079). **Comparison of low dose acute oral toxicity of methyl parathion and sumithion.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 533; 1976.

Previous work has shown that it is possible to accurately determine the LD1 and extrapolate the LD01 for five carbamate pesticides and for five organophospate pesticides. Newer studies have compared methyl parathion and sumithion (fenitrothion) in a similar manner. LD50s and LD1s were determined for methyl parathion and sumithion utilizing computer based balanced and unbalanced probit methods. Values were males 14.5 (13.7-15.4) and females 19.5 (18.2-20.9) mg/kg for methyl parathion. The differences were significant at P= 10.05 and the chemical was more toxic to males. Values for sumithion were males 1045 (995-1097) and females 1220 (1025-1452) mg/kg. There was no significant difference in toxicity between the sexes. The LD1s of methyl parathion were males 8.46 (7.17-9.18) and females 9.58 (8.19-10.47) mg/kg and for sumithion 673.6 (591-722.3) and 693 (637.4-731.5) mg/kg, respectively. The extrapolated LD0.1 for methyl parathion was males 7.07 (5.41-8.02) and for females 7.63 (5.91-8.02) mg/kg and for sumithion males 578.2 (465.6-641.1) and females 607.1 (535-655.7) mg/kg, respectively. The slopes of the lines were parallel in both experiments indicating the same mode of action. From a structure-activity standpoint, the addition of a methyl group in the meta position of the nitrophenyl moiety decreased the toxicity of sumithion by 62-72% compared to methyl parathion. (Abstract no. 1804 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0975. Burrows, G. E.; Way, J. L. (Dep. Vet. Sci., Univ. Idaho, Moscow, ID 83843). **Antagonism of cyanide toxicity by phenoxybenzamine.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 533; 1976.

The classical antidotes of sodium nitrite and sodium thiosulfate have been employed for 40 years as antagonists of cyanide toxicity. During that period of time, various other antidotes have been investigated and promulgated, i.e., methylene blue, various cobalt compounds,

other methamoglobin formers, chlorpromazine, and oxygen. All of these very diverse approaches to cyanide toxicity require the concurrent use of sodium thiosulfate for full expression of their antidotal potency. However, only a few involve the formation of methemoglobin. In an attempt to elucidate a possible common mechanism of action, the present studies were initiated involving phenoxybenzamine (PBZ), a powerful α adrenergic blocking drug. Mice were given PBZ (2.5 mg/kg, i.p.) and/or sodium thiosulfate (1 g/kg, i.p.) 30 and 15 minutes, respectively, prior to administration of potassium cyanide (subcutaneous). PBZ, similar to the various other antidotes promulgated, was of very limited value when used alone as a cyanide antidote. However, when PBZ was combined with sodium thiosulfate, a very marked protective action was observed against cyanide-induced lethality. Administration of the PBZ sodium thiosulfate combination did not elicit the formation of detectable methemoglobin levels. These studies suggest an important role for the selective augmentation of peripheral vascular flow in the antagonism of cyanide-induced lethality. (Abstract no. 1805 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0976. Niden, A. H.; Khurana, M. M. L. (Drew Postgrad. Med. Sch., Los Angeles, CA 90059). **An animal model for diffuse interstitial pulmonary fibrosis-chronic low dose paraquat ingestion.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 631; 1976.

Forty-four mice were placed on low concentration paraquat in their drinking water (50 ppm) ad libitum. As tolerance to the paraquat developed, the concentration was increased by 50 ppm every 3 weeks. A maximum concentration of 750 ppm was reached by 9 months. The above dose schedule resulted in a 25% mortality rate while higher concentrations of paraquat resulted in an unacceptable high mortality rate. Experimentally treated mice and age-matched controls were sacrified at monthly intervals and lung tissue prepared for light (L.M.) and electron microscopy (E.M.) by standard techniques. At one month there was minimal inflammatory reaction throughout the lung with no increase collagen deposition as ascertained by L.M. collagen stain. E.M. revealed minimal increase in collagen in interstitial spaces. All lungs examined from 2-9 months revealed diffuse mononuclea cell infiltration with progressive increase in interstitial collagen deposition. Preliminary observations indicate that chronic ingestion of low dose paraquat results in a reliable, reproducible, slowly developing animal model for studying diffuse interstitial pulmonary fibrosis, its development, prevention, and treatment. (Abstract no. 2340 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0977. Abou-Donia, M. B. (Dep. Physiol. Pharmacol., Duke Univ. Med. Cent., Durham, NC 27710). **Pharmacokinetics of a sub-neurotoxic dose of leptophos.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 664; 1976.

A pharmacokinetic profile of a sub-neurotoxic dose of leptophos was determined in laying hens following a single oral dose of 50 mg/kg (1.0μCi) of ^{14}C-phenyl leptophos [*O*-(4-bromo- 2,5-dichlorophenyl) *O*-methyl phenyl-^{14}C- phosphonothioate]. A major part of the radioactivity (86/47%) was recovered in egg albumen and yolk respectively. Only 1.25% was recovered in the expired CO_2 collected continually for 20 days. Twelve hours after the administration, radioactivity in tissues reached a peak of 14.58% of the administered dose, which was decreased to 6.21% at 20 days (42.59% of peak value). Radioactivity was highest in the muscle, followed by skin and adipose tissues. Brain, spinal cord, and sciatic nerve, which are affected by the neurotoxicity of leptophos, had small amounts of radioactivity that were constant throughout the 20-day experiment. Following the oral administration of ^{14}C-leptophos a biexponential body burden curve was observed. The physiological disposition of leptophos may therefore be defined in terms of a two-compartment open-system model. This neurotoxic insecticide was eliminated at a slow rate, a value of 0.06/day corresponding to a half-life of 11.55 days. (Abstract no. 2533 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0978. Goldstein, J. A.; Hickman, P.; Bergman, H. (Environ. Protect. Agency, Research Triangle Park, NC 27711). **Induction of hepatic porphyria and drug-metabolizing enzymes by 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD).** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 708; 1976.

Female weanling rats dosed by stomach tube with 0, 0.01, 0.1, 1 and 10 μg/kg/wk TCDD for 16 wk were sacrificed 1 wk after the last dose. Rats dosed with 10 μg/kg/wk TCDD died before sacrifice. Total liver porphyrins were elevated in 7/8 rats at 1 μg/kg/wk (mean 1000 × controls), and in 1/8 at 0.1 μg/kg/wk. Significant increases in hepatic aryl hydrocarbon hydroxylase (AHH) occurred at all doses (3-48 ×), glucuronyl transferase (GT) at 0.1 (4 ×) and 1 μg/kg/wk (74%), and δ-aminolaevulinic acid synthetase (ALAS) by 0.1 (40%) and 1 μg/kg/wk (4 ×). *N*-demethylase was not affected. The 455/430 ratios of the ethyl isocyanide difference spectra were increased by 0.1 and 1 μg/kg/wk. Another group of rats given 1 μg/kg/wk for 16 wk were allowed to recover for 6 mo. After recovery, AHH was elevated 2 ×, GT 2 ×, and cytochrome P-450 and ethyl isocyanide ratios returned to normal. Urinary porphyrins remained elevated after recovery, ALAS was elevated 2.5 ×, and 6/8 rats were grossly porphyric (mean hepatic porphyrins 70 × controls). Rats sacrificed 3 days or 16 wk after single oral doses of 0, 1, 3, 10 and 30 μg/kg TCDD were not porphyric, indicating porphyria occurs only after chronic dosing. In contrast, 16 wk after single doses of 3, 10 and 30 μg/kg, AHH was increased 80%, 3 × and 5 ×, and CT 74% (10 μg/kg) and 105% (30 μg/kg). (Abstract no. 2765 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0979. Chinn, C.; Pfister, W. R.; Yim, G. K. W. (Dep. Pharmacol. Toxicol., Purdue Univ., West Lafayette, IN 47907). **Local anesthetic-like actions of the pesticide, chlordimeform (CDM).** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 729; 1976.

The chemical structure of CDM, *N'*-(4-chloro-*o*-tolyl)- *N,N*-dimethyl formamidine, is similar to that of the local anesthetic piperacaine. Following CDM (150 mg/kg, i.p.) rats showed hyperactivity, tremors, convulsions, and respiratory arrest. In the urethane anesthetized rat, intravenous CDM (10-40 mg/kg) produced depressor responses, with respiratory arrest at the higher doses. When injected into the lateral ventricle, CDM (250-1000μg) produced dose dependent pressor or biphasic responses with little effect on heart rate, and respiratory arrest at higher doses. Similar effects were observed with procaine and lidocaine. CDM reversibly blocked the isolated frog sciatic nerve. The ED50s of CDM, procaine, and piperacaine, were 30, 20 and 7 m*M* respectively. The results suggest that many of the pharmacological and toxic actions of CDM can be attributed to the local anesthetic actions of CDM. (Abstract no. 2887 from the 60th annual meeting of FASEB, Anaheim, CA, Apr. 11-16, 1976, reprinted by permission)

76-0980. Laskowski, M. B.; Olson, W. H.; Dettbarn, W. D. (Vanderbilt Univ. Sch. Med., Nashville, TN 37232). **Motor end-plate degeneration coincident with cholinesterase (ChE) inhibition and increased miniature end-plate potential frequency.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 800; 1976.

Paraoxon, an organophosphorus inhibitor of ChE, produces a 38-fold increase in MEPP frequency in rat diaphragm muscles when given s.c. This increased frequency lasts for 6 hr. Light microscopy reveals a myopathy developing within 6 hr after paraoxon. In this study the ultrastructure of motor end-plates was examined 30 min and 6 hr after 0.25 mg/kg paroaxon s.c. After 30 min the subsynaptic muscle fine structure is disrupted, including dilated sarcoplasmic reticulum and mitochondria to a distance 7.01 μ from the nerve terminal membrane. Nerve terminals are unchanged except for occasional clusters of coated vesicles. Six hours after paraoxon the myopathy has not progressed from the nerve terminal (7.00 μ), but vesicular structures appear in the subsynaptic folds. At this time some muscle fibers show abnormal structure in areas with no adjacent end-plate. When animals are treated 10 min after paraoxon with a reactivator of phosphorylated ChE (20 mg/kg 2-PAM) MEPP frequency is greatly reduced and all the above myopathic changes are prevented. It is concluded that the myopathic effects of paraoxon are produced by ChE inhibition and involve two mechanisms: degeneration of the subsynaptic sarcoplasm, and generalized fiber breakdown. It remains to be determined whether degeneration beneath the end-plate triggers general fiber breakdown. (Abstract no. 3276 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0981. Cisson, C. M.; Nieberg, P. S.; Wilson, B. W. (Univ. California, Davis, CA 95616). **Recovery of acetylcholinesterase in paraoxon-treated chick embryo muscle cultures.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 800; 1976.

Acetylcholinesterase (AChE) activity rapidly recovers in cultured muscle after inhibition by a brief treatment with DFP. The behavior of the enzyme during recovery suggests it is rapidly synthesized and degraded. This study was designed to compare recovery of cells from paraoxon (PO) and DFP treatments. Muscle cultures were grown for one to two weeks in vitro from cells of 11-day chick embryo breast. Cultures were treated for 10 minutes with 0.1 m*M* to 0.4 n*M* solutions of PO (95% purity) and their AChE activity, cytochemical localization, and isozyme pattern determined. 150 was 0.8 n*M* with both intact cells and homogenates. As with DFP treatment, cells recovered AChE activity within several hours after PO treatment so long as protein synthesis occurred. Low AChE activity could be detected around the nuclei as early as 30 minutes after PO treatment. In 2-4 hours, AChE spread throughout the fibers. When low doses of PO (ca. 1n*M*) were used to partially inhibit AChE, the more enzyme activity was inhibited, the more rapid was its recovery. Whether this was due to a small differential reactivation of AChE or an inhibition of enzyme degradation is under study. Regardless, the results suggest that muscle cells recover from PO and DFP mainly, if not solely, by synthesis of new AChE. (Abstract no. 3277 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0982. Bellward, G. D.; Dawson, R.* ; Otten, M. (Div. Pharmacol. Toxicol., Fac. Pharm. Sci., Univ. British Columbia, Vancouver, British Columbia, Canada). **Effect of methadone, dieldrin, and other drugs on rat hepatic microsomal epoxide hydrase and aryl hydrocarbon hydroxylase.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 817; 1976.

Studies were initiated to find a series of compounds which might selectively increase or decrease the activities of epoxide hydrase (E.H.; determined with styrene oxide) and aryl hydrocarbon hydroxylase (AHH; determined using benzpyrene). Male rats exposed to 25 ppm dieldrin in their diet exhibited a 2.5-fold increase of EH over control levels after 2 weeks. AHH was not elevated at any time period (0-30 days) or dose (0-25 ppm). Methadone (M) was added to the drinking water of adult rats in increasing amounts up to a final dose of 85 mg/kg day in the 4th week. Female rats were found to exhibit an increase in AHH to 222% of control levels. No change in EH activity occurred. In contrast, male rats exhibited an increase in EH (156% of controls) with no change in AHH. Results were similar in newly-weaned animals. This suggests that the sex differences seen may be imprinted during fetal development or early life. Concurrent administration of M with other drugs (e.g. phenobarbital sodium, 3-methycholanthrene, and alcohol) was also studied. Phenobarbital and

3-methylcholanthrene produced additive effects with M on EH activity in male rats. Results are too preliminary to determine the mechanism of induction by M as yet. (Abstract no. 3377 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0983. Webb, G. D.; Sharp, R. W.*; Abell, E. M. (Univ. Vermont, Coll. Med., Burlington, VT 05401). **Effects of some insecticides on sodium efflux from human erythrocytes.** *Fed. Proc. (Fed. Am. Soc. Exp. Biol.)* 35(3): 835; 1976.

Previous work in our laboratory has shown that DDT inhibits electric eel Na-K ATPase and that several insecticides inhibit the short-circuit current (SCC) of isolated frog skin. In this study, ^{22}Na-loaded erythrocytes (RBC) were exposed for 70 minutes to: a control solution, 0.1 m*M* ouabain, or various concentrations of insecticides with and without 0.1 m*M* ouabain. Active Na transport in RBC was altered by insecticide concentrations as low as 10 μM, whereas at least 0.1m*M* was necessary to see effects on frog skin. DDT and heptachlor both had very little effect on the SCC of frog skin but both insecticides inhibited active Na efflux from RBC at concentrations as low as 10 μM. At 0.1m*M* lindane inhibited Na efflux, whereas at lower concentrations it produced a slight increase. Lindane also increased the SCC in frog skin. Nonachlor inhibited the active Na efflux from RBC while simultaneously increasing the passive Na efflux. At 0.1m*M* carbaryl and dieldrin slightly inhibited Na efflux. The active Na-transport system in RBC is thus more accessible, or sensitive, to externally applied agents than that of frog skin. Some insecticides inhibit the active transport of Na at concentrations low enough to suggest that such inhibition might play a role in producing some of the symptoms of acute insecticide poisoning. (Abstract no. 3472 from the 60th annual meeting of FASEB, Anaheim, CA Apr. 11-16, 1976, reprinted by permission)

76-0984. Perelygin, V. M.; Vrochinskiy, K. K.; Predlovskaya, E. D. (Kirghiz Sci. Res. Inst. Epidemiol. Microbiol. Hyg., Kirghiz, USSR). **Materialy k obsnovaniyu predel'no dopustimoy kontsentratsii fenurona v vode vodoemov. [Data to substantiate the permissible concentration of fenuron in water bodies.]** *Gig. Sanit.* 10: 22-25; 1975. (2 references) (Russian)

Complex toxicological and hygienic testing of fenuron was performed to substantiate a maximum permissible concentration in water. The acute oral LD50 was determined to be 3,200 mg/kg for guinea pigs and 7,550 mg/kg for albino rats. The threshold dose was found to be 15 mg/kg, and the subthreshold dose 1.5 mg/kg in chronic poisoning tests. Chronic poisoning tests revealed functional disturbances in the endocrine and hemopoietic systems, changes in the immune reactivity, blockade of the blood SH groups, and retarded gain in weight. Fenuron was found to be persistent in water. The concentration in water decreased by 40% in 30 days. The organoleptic threshold in water was found to be 49.4 mg/liter. The pesticide stimulated biochemical oxygen consumption, decreased the dissolved oxygen content, stimulated the saprophytic microflora, and caused temporary inhibition of nitrification processes and temporary intensification of ammonification processes at concentrations of 2 mg/l and higher. At 0.2 mg/l it had no effect on the aqueous environment. The maximum allowable fenuron concentration in water intended for human use is recommended to be set at 0.2 mg/l.

76-0985. Aleksandrova, L. G. (Kiev Sci. Res. Inst. Ind. Hyg. Occup. Dis., Kiev, USSR). **Nakoplenie i raspredelenie ronita v organizme teplokrovnykh zhivotnykh. [Accumulation and distribution of ro-neet in the body of warm-blooded animals.]** *Gig. Sanit.* 10: 29-31; 1975. (3 references) (Russian)

The accumulation and distribution of ro-neet (cycloate), administered into the stomach of rats in the maximum tolerable dose of 1 mg/kg, was studied in different internal organs and in the blood. The analyses were done by a thin-layer chromatographic method at a sensitivity of 20 μg/g. One hour after administration, the ro-neet concentrations were highest in the lungs, kidney, liver, heart, and spleen, and the concentration peaked 2 hr after administration in the brain. A second concentration maximum was observed in the spleen and lungs 3 hr after poisoning. In general, the following decreasing order of concentrations was established: lungs, kidneys, heart, spleen, liver, and brain. The ro-neet concentrations in the blood were 3.16 μg/ml after 30 min, 10 μg/ml after 1-6 hr, and 1.56 μg/ml after 18 hr. No residues were found in the organs and in the blood after 24 hr. The findings indicate the rapid resorption of ro-neet from the gastrointestinal tract, and rapid elimination from the organism.

76-0986. Izraylet, L. I.; Drozdova, L. V.; Eglite, M. E. (Riga Med. Acad., Riga, USSR). **Gigienicheskaya otsenka boverina i nekotorye perspektivy primeneniya mikrobiologicheskihk sredstv zashchity rasteniy. [Hygienic evaluation of boverin and some prospective uses in plant protection.]** *Gig. Sanit.* 11: 91-94; 1975.

Acute and chronic toxicological tests are discussed on albino rats and guinea pigs, and results are presented of clinical examinations of workers exposed to spores of *Beauveria bassiana* in boverin production. It was not possible to isolate vegetative forms of *B. bassiana* from different tissues after administration by intratracheal, intragastric, or intravenous routes, nor after inhalation. Single doses of 200-2,000 mg/kg caused no deaths, and no cumulation was observed after introduction of 2,000 mg/kg into the stomach for 2 mo. Chronic inhalation tests revealed a minimal effective concentration of 5 mg/m^3, with allergic and immunological changes being the limiting factors. The maximum allowable concentration of boverin in the air should be set at 0.3 mg/m^3. Skin rash, allergy, reduced

phagocytic activity, subtrophic and hypertrophic rhinopharyngites, and vasomotor rhinites were found in workers exposed to *B. bassiana* spores in boverin production. The findings indicate that boverin is not pathogenic but is a weak allergen. It exhibited no tropism in its action on the organism.

76-0987. Khaykina, B. I.; Yakushko, V. E.; Novikova, N. P. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pesticides, Polymers and Plastics, Kiev, USSR). **Vliyanie nekotorykh khlororganicheskikh pestitsidov na aktivnost' glyukozo-6-fosfatdegidrogenazy eritrotsitakh. [Effect of some organochlorine pesticides on glucose-6-phosphate dehydrogenase activity in erythrocytes.]** *Gig. Sanit.* 11: 117-118; 1975. (Russian)

The effect of different doses of DDT, lindane, and polychlorocamphene (toxaphene) on the glucose-6-phosphate dehydrogenase activity of the erythrocytes was studied in male white rats in acute and chronic experiments by oral administration. Lindane, administered in a daily dose of 34 mg/kg for 3 days, or in a daily dose of 1.7 mg/kg for 10, 30, or 120 days, reduced the glucose-6-phosphate dehydrogenase activity by 16-25%. Similar findings were obtained for DDT. Administered in a single dose of 120 mg/kg (50% LD50), polychlorocamphene inhibited the glucose-6-phosphate dehydrogenase activity by 18% on the first day, and by 15% on the 5th day. The enzyme activity was normal 15 days after poisoning. Administered in a daily dose of 2.4 mg/kg (1% of LD50) for 30 or 90 days, polychlorocamphene did not cause any change in the enzyme activity, but it caused a 24% reduction after the administration of this dose for 120 days. The reduction of the glucose-6-phosphate dehydrogenase activity during the prolonged administration of these organochlorine pesticides is assumed to be due to the accumulation of these substances in the organism. The aplastic anemia caused by DDT may be related to its inhibition of the glucose-6-phosphate dehydrogenase activity. The changes also indicate an effect of DDT, lindane, and polychlorocamphene on the pentose phosphate metabolism in the erythrocytes.

76-0988. Bhan, A. K.; Kaul, B. L. (Regional Res. Lab., Jammu, Tawi, India). **Cytogenetic activity of dichlorvos in barley.** *Indian J. Exp. Biol.* 13(4): 403-405; 1975. (12 references)

Results are reported on the lethal, cytological, and mutagenic effects of DDVP (dichlorvos) on dormant seeds of barley (*Hordeum vulgare*). Dichlorvos was used at 0.25, 0.50, and 0.75 m*M*. Seeds were treated for 6 and 18 hr. All doses of both 6 and 18 hr treatments reduced seed germination, seedling height, and M_1 seed fertility marginally. In general 18 hr treatments produced slightly more damage, but the effects were not dose dependent. The number of dividing cells was appreciably reduced by DDVP as measured by mitotic index. Chromosomal aberrations were induced by all the treatments. The frequency of aberrations increased in proportion to the concentration as well as the duration of treatment. Aberrations were of the breakage type, including chromatid and isolocus breaks and free fragments. Meiosis was usually normal, but occasional aberrancies were noted as polyploid cells and tetravelent chromosome formations. Seed fertility was not affected appreciably by the 6 hr treatment, but the 18 hr treatment reduced seed fertility by as much as 16%. No chlorophyll deficient mutants appeared among 3301 seedlings grown as panicle progeny derived from 266 M_1 plants. While there are unquestionable lethal effects of DDVP, further investigations are needed to confirm possible genetic implications for higher systems.

76-0989. Karanth, N. G. K.; Chitra, C.; Vasantharajan, V. N. (Microbiol. Pharmacol. Lab., Indian Inst. Sci., Bangalore 560012, India). **Effect of fungicide, Dexon on the activities of soil enzymes.** *Indian J. Exp. Biol.* 13: 52-54; 1975. (17 references)

The effect of the fungicide, Dexon (fenaminosulf), is reported on some of the important enzyme activities in soil. Dexon was applied to the soil at 0, 20, 100, and 200 ppm concentrations. Dexon caused 30 to 50% inhibition of dehydrogenase activity. There was no significant difference between the various concentrations used, as 20 ppm considerably inhibited the respiration rate. Fungicide treatment suppressed the activity of tryptophanase only at higher concentrations. At lower concentrations (20 ppm) the activity was enhanced by 54% over controls during 4 days' incubation. Suppression of the activity at the higher concentrations was noted only after 2 days. The activity was reduced to 60% in 4 days and 70 to 85% in 5 days. Low concentrations (20 ppm) enhanced invertase activity. Higher concentrations resulted in 20% inhibition in 1 day and 40% in 4 days. Invertase was very sensitive to 200 ppm Dexon; a reduction of 81% was noted on the 4th day. Urease enzyme activity studies showed ureolysis to be rapid in untreated soils as well as in those treated with low concentrations of Dexon. Higher concentrations caused marked reduction in this activity. The fungicide inhibited the phytase activity at all 3 concentrations used. Maximum inhibition of 30 to 40% was obtained after 1 day. As time passed, however, a steady increment in this activity was noted at all concentrations. The results of this study indicate that Dexon can affect several processes in nature. As far as oxido-reductive enzyme activities are concerned, the fungicide inhibited these at all concentrations tested. These findings indicate that the fungicide may have a wider spectrum of activity than is claimed. It is noted that the activities of all the enzymes are inhibited at the normally recommended field doses of 100 and 200 ppm.

76-0990. Taylor, W. A.; Sheldon, D. (Res. Dep., Miles Lab., Ltd., Stoke Court, Stoke Poges, Bucks. England). **Mast cell degranulation: a comparison of the inhibitory actions of disodium cromoglycate, drugs known to influence the level of intracellular cyclic nucleotide and diisopropylfuorophosphate (DFP).** *Int. Arch. Allergy Appl. Immunol.* 47(5): 696-707; 1974. (13 references)

Rat peritoneal mast cells were used to investigate the effects of drugs on the calcium-independent and calcium-dependent stages of phospholipase-A-induced mast cell degranulation. Results of the study suggest that disodium cromoglycate and drugs known to raise the level of intracellular cyclic AMP block the degranulation process during or after the calcium-dependent step. The cyclic AMP active drugs and disodium cromoglycate potently inhibited calcium-independent compound 48/80-induced degranulation. Diisopropylfluorophosphate, however, which potently inhibited antigen-induced mast cell degranulation, did not inhibit either calcium-independent 48/80- or calcium-independent noradrenaline-induced degranulation. It is concluded from this study that cyclic AMP and drugs thought to influence the intracellular level of this cyclic nucleotide appear to influence the process of degranulation at or after the calcium-dependent step. Disodium cromoglycate also appears to block degranulation after the calcium-dependent step. This finding is consistent with the hypothesis that the therapeutic effect of this drug is due to its inhibition of mast cell phosphodiesterase.

76-0991. Skromme-Kadlubik, G.; Alvarez-Cervera, J.; Cortes-Marmolejo, F. (Radionuclide Lab., Fac. Med., U.N.A.M. Mexico City, Mexico). **Adrenal scanning with dichloro-diphenyl- dichloroethane-^{131}I (DDD-^{131}I)—a clinical report on 100 subjects.** *Int. . Nucl. Med. Biol.* 2(2): 83-96; 1975. (7 references)

Adrenal scanning performed in 100 subjects with various adrenal conditions is described. DDD-^{131}I was administered p.o. for a total of 128 tests. The average test dose was 200-350 μCi, with a specific activity ranging from 20 to 100 μCi/mg. Of 100 subjects, 56 were normal subjects and 44 were cases of adrenal pathology. The normal pattern was studied in resting and functioning adrenal gland, as well as after stress. It is noted that the circadian rhythm of the labeled DDD follows the variations of the adrenal gland, possibly due to feedback control and endogenous ACTH regulation. Adrenal scanning was performed on 6 subjects before a total nephrectomy and a few weeks after the operation. The patients were in a state of stress before surgery and the scan exhibited a marked decrease in the uptake. In the later examination the scan reverted to higher (2 to 3 times) uptake. Parenteral administration of ACTH caused an inhibition in the adrenal scan with the image 2 to 3 times weaker. In 4 subjects who took steroids for 3 days before the scan, the image was notably more accentuatued than that obtained before steroid treatment. This method is safe, simple, and has a high degree of accuracy which makes it useful in clinical practice.

76-0992. Gardiner, J. A.; Kirland, J. J.; Klopping, H. L.; Sherman, H. (Biochem. Dep., E. I. du Pont de Nemours & Co., Inc., Wilmington, DE 19898). **Fate of benomyl in animals.** *J. Agric. Food. Chem.* 22(3): 118-126; 1974. (15 references)

A male ChR-CD rat was given a diet containing 2500 ppm benomyl or methyl 2-benzimidazolecarbamate (MBC) and 12 days later was given acetone-peanut oil containing 7.7 mg (2-^{14}C)benomyl or 5.28 mg (2-^{14}C)MBC by stomach tube. In other studies, rats and male beagle dogs were given 2500 ppm benomyl in the diet up to 2 yr; in one study, a benomyl-treated dog was given 30.8 mg labeled benomyl orally after 7 weeks on the benomyl diet. Guernsey dairy cows were also given 0-50 ppm benomyl in the diet for 32 days, and White Leghorn laying hens were given 0-50 ppm benomyl in the diet for 4 weeks. The rat and dog eliminated more than 99% of the single oral dose of labeled benomyl via the urine and feces within 72 hr. The major metabolite was methyl 5-hydroxy-2-benzimidazolecarbamate (5-HBC), which was present in the urine as glucuronide and/or sulfate conjugates. The dairy cows and chickens showed the same route of metabolism and elimination. The data from all studies indicated that benomyl and its residues do not accumulate in animal tissues. Milk from the dairy cows and eggs from the chickens contained detectable residues (0.1 ppm or less) only when benomyl was fed in concentrations of 25-50 ppm. MBC was metabolized in and eliminated from the rat in the same manner as benomyl. Methods of synthesis for benomyl and its three breakdown products are described.

76-0993. Bodor, N.; Shek, E.; Higuchi, T. (INTERx Res. Corp., Lawrence, KS 66044). **Improved delivery through biological membranes. I. Synthesis and properties of 1-methyl-1,6-dihydropyridine-2-carbaldoxime, a pro-drug of *N*-methylpyridinium-2-carbaldoxime chloride.** *J. Med. Chem.* 19(1): 102-107; 1976. (34 references)

A dihydropyridine-pyridine type redox pro-drug system was developed for delivering quaternary pyridinium salts through biological membranes. As a first application of this technique, the dihydropyridine derivative of *N*-methylpyridinium-2-carbaldoxime chloride (2-PAM) was synthesized using a reduction-addition-elimination sequence. THe dihydro-2-PAM obtained was studied to establish its merits as a useful pro-drug of 2-PAM. At physiological pH, dihydro-2-PAM exists as a free base, which is significantly more lipoidal than its salt or 2-PAM, and it could be quantitatively oxidized to 2-PAM. These properties suggest that the dihydro derivative would be an attractive and useful pro-drug of 2-PAM.

76-0994. Krebs, C. T.; Valiela, I.; Harvey, G. R.; Teal, J. M. (Boston Univ. Marine Program, Marine Biol. Lab., Woods Hole, MA 02543). **Reduction of field populations of fiddler crabs by uptake of chlorinated hydrocarbons.** *Mar. Pollut. Bull.* 5(9): 140-142; 1974. (24 references)

A commercial fertilizer manufactured from sewage sludge was added to plots in Great Sippewissett Marsh, West Falmouth, Mass., to test the effects of contamination on salt marsh ecosystems. Weekly doses of 25.2 g/m^2 and 8.4 g/m^2 of the sludge fertilizer were added at low tide to each of two replicate plots from May to November, 1970. During early November, lower densities of crabs were

noted beginning to hibernate in the plots which had the higher doses of sewage contamination. In addition, both doses increased the number of crabs found dead or inactive on the marsh surface. The usually rapid escape response was very slow or absent in crabs in whom the locomoter impairment was recreated by 10 days of laboratory feeding on sediments from the treated plots. By analyzing some of the sludge fertilizer, it was determined that the fertilizer contained very high and variable concentrations of aldrin (1.4 to 117 ppm), lower amounts of dieldrin (0.01 to 2.1 ppm), and no detectable amounts of DDE and PCB. All surface sediment and crab samples contained low but fairly uniform amounts of DDE, probably resulting from DDT degradation from the now abandoned practice of spraying salt marshes with this insecticide. The amounts of DDE found indicate that live crabs concentrate DDE three times above the levels present in the sediments on which they feed. The ratio of aldrin to dieldrin in the sediments suggests that this may result partly from microbial epoxidation of aldrin to dieldrin. The dieldrin in live crabs correlated well with the degree of locomotor impairment observed, while the levels of aldrin were independent of dose. From the results of this study showing the high concentration of aldrin and dieldrin in the sludge fertilizer, the surface sediments of treated plots, and the crabs exposed to these treated sediments plus the bioassay results, it is concluded that these insecticide contaminants were responsible for the drastic reduction observed in the fiddler crab populations.

76-0995. Mollet, P.; Wurgler, F. E. (Swiss Fed. Res. Stn., Waedenswil, Switzerland). **Detection of somatic recombination and mutation in Drosophila. A method for testing genetic activity of chemical compounds.** *Mutat. Res.* 25(3): 421-424; 1974. (12 references)

The usefulness was studied of somatic recombination and mutation in Drosophila larvae as a test for potential mutagens. To test the method, the frequency of mosaic eyes induced by two different chemicals was recorded. The chemicals were captan, a fungicide, and methyl methanesulfonate (MMS). The data from the study indicates that captan, not mutagenic in the conventional tests with germ cells, also does not induce recombination and mutation in somatic cells. In contrast, MMS induced both somatic crossing over a mutation. These studies indicate that the induction of somatic recombination and mutation in Drosphila larvae is a promising test for potential mutagens. It may even be useful for screening purposes. In comparison to conventional test systems it has the advantages of being a quick, one-generation test; allows recombination and mutation to be detected in the same test; and each eye, treated as an imaginal disc in a first instar larva, represents a minimum of 10 tested cells. The disadvantages are that somatic and not germ cells are investigated, the genetic alterations present in eye spots cannot be analyzed further by genetic methods, and the detection of spots may need more experience than the scoring of recessive lethals or translocations.

76-0996. Kramers, P. G. N.; Knaap, A. G. A. C.; Voogd, C. E. (Dep. Radiat. Genet. Chem. Mutagenesis, State Univ. Leiden, Leiden, The Netherlands). **Lack of mutagenicity of chloromequat chloride in Drosophila and in bacteria.** *Mutat. Res.* 31(1): 65-68; 1975. (11 references)

Studies concerned with the mutagenicity of (2-chloroethyl)trimethylammonium chloride (CCC, chlormequat) were carried out using *Drosophila melanogaster* and with two species of bacteria: *Klebsiella pneumoniae* and *Citrobacter freundii*. In Drosophila tests, two types of genetic damage were measured in male germ cells, namely sex-linked recessive lethal mutations and dominant lethal mutations. CCC was given by injection into the abdomen of 4 day old males at concentrations of 1 and 10 mg/ml in saline. The injection of CCC did not increase the mutation rate over the control frequency. The ability of CCC to induce dominant lethal mutations was studied using wild type flies. No evidence was found for the induction of dominant lethal mutations by CCC. Additional studies on CCC metabolism demonstrated that most of the injected compound was still present 3 hr after injection, thus excluding the possibility that the lack of mutagenic effect of CCC was due to a rapid metabolic breakdown of the compound. No evidence was found for a mutagenic activity of CCC in the bacteria *Klebsiella pneumoniae* or *Citrobacter freundii*.

76-0997. Bousch, G. M.; Matsumura, F. (Dep. Entomol. Univ. Wisconsin, Madison, WI 53706). **Pesticide degradation by marine algae.** *Natl. Tech. Inform. Serv.*, AD-A008 275, 1975, 23 p.

Various algae species are tested for their susceptibilities towards chlorinated hydrocarbon insecticides. Dieldrin, which is the most frequency found pesticidal contaminant in the U.S., and its analogs were found to inhibit the growth of certain algae species. *Anacystis nidulans* in particular showed marked susceptibility to endrin, dieldrin, ketoendrin, and photodieldrin. This species was also susceptible towards dieldrin metabolites such as metabolite F and G. Among DDT metabolites, DDD (TDE) was found to be the most toxic material, followed by DDE, DDT, and FW-152. It has not been known that DDT should be more toxic to algae. In terms of acute toxicity phenylmercuric acetate was by far the most algicidal agent among all pesticidal chemicals tested. This pesticide is toxic to both *A. nidulans* and *A. quadruplicatum* at the concentration of 1 ppb. Algae, along with other plankton, are known to bioaccumulate pesticides and thereby play a vital role in the process of food-chain accumulation of these micropollutants. Our studies indicate that the rates of pick-up of pesticides are very rapid. To study the feasibility of constructing a model ecosystem algae was used as a key food chain organism. This way could demonstrate that TCDD, the most toxic contaminant of 2,4,5-T does not really accumulate in the aquatic organisms as compared to DDT. Algae as a whole are not very active in degrading pesticidal chemicals in vivo. They were found to play, however, a key role in the process of

environmental alteration of pesticidal residues. The way they participate in such processes was found to be through synergistic actions on photochemical reactions. Algal products, when tested in the form of aqueous extract from dead algal cells, were found to be excellent photosensitizers for DDT and mexacarbate degradation by the sun-light (simulated sun lamp). (Author abstract by permission)

76-0998. Weeks, M.; Boldt, R.; Pope, C. R. (Army Environ. Hyg. Agency, Aberdeen Proving Ground, MD 21010). **Hazard evaluation of aerosol formulations containing the synthetic pyrethroid insecticide (5-benzyl-3-furyl) methyl-2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate (SBP-1382).** *Natl. Tech. Inform. Serv.* AD-770 403, 1973, 18 p. (5 references)

Inhalation studies were made using rats to obtain information on the possible adverse effects from daily intermittent 5-day exposure to aerosol sprays containing combinations of SBP-1382; deodorized kerosene (Bayol 35); and propellants (Freon 11 and Freon 12). Toxicity related to the insecticide, SBP-1382, was not observed in rodents exposed to aerosols containing the technical grade SBP-1382 and Freon 11 and 12 at a concentration of 7.3 mg SBP-1382/l of air. Transient toxic signs were observed in animals exposed to aerosol preparations containing Bayol 35. No prenatal toxicity was observed in pregnant rats exposed to aerosol preparations containing SBP-1382. (Author abstract by permission)

76-0999. Leather, G. R.; Sterret, J. P. (Edgewood Arsenal, Aberdeen Proving Ground, MD 21010). **Nonherbicidal defoliants. IV. Ecological effects of endothall/ethephon.** *Natl. Tech. Inform. Serv.*, AD-775 428, 1974, 17 p.

Some ecological effects from the use of the growth regulators, ethephon and endothall in combination, have been examined and found to be minimal. The ethylene evolution from μmoles of ethephon in phosphate-buffered solution, pH 6.5, attained a maximum rate of about 950 μl/liter per hr after 1 day. Ethephon was absorbed by the roots in nutrient solution causing a 50% growth inhibition at 0.5 to 1.0 mg/l. However, untreated companion plants located adjacent to foliar-treated plants showed no epinasty, abscission, or growth inhibition over a 7-day period in soil or nutrient solution. Translocation of ^{14}C-ethephon was evident throughout the plant 4 hr after foliar application. No exudation of radioactive material from the roots of foliarly treated plants was detected. Addition of endothall did not alter exudation of ethephon or ethylene evolution. Ecological effects involved with large-scale applications of endothall/ethephon are assessed by projection of the laboratory results. (Author abstract by permission)

76-1000. Alexander, M. (Dep. Agron., Cornell Univ., Ithaca, NY 14850). **Microbial degradation of DDT.** *Natl. Tech. Inform. Serv.*, AD-781 903, 1974, 34 p. (29 references)

One-half of the marine bacteria tested converted DDT to water-soluble products. *Mucor alternans* converted DDT to water-soluble metabolites at a rate four times greater than the most active marine bacterium. Techniques were developed to isolate and purify these metabolites. These compounds are different from the previously described DDT metabolites, and they do not contain chlorine. If the absence of chlorine is confirmed these compounds represent products of the most extensive microbial degradation of DDT yet reported. To model marine communities, eighty different carbon sources were added in a total of 100 separate treatments, but in no case were water-soluble products of DDT metabolism detected. Microorganisms were found to be capable of converting diphenylmethane, an analog of DDT, to 1,1,1',1'-tetraphenyldimethyl ether, and studies are underway to determine whether microorganisms can carry out this same reaction with the DDT metabolite bis(*p*-chlorophenyl)benzhydrol. Micororganisms able to grow at the expense of various carbon sources having a structural relationship to DDT were isolated and the ability of these isolates to dechlorinate DDT, its metabolites, and its analogs is now being tested. During the isolations, it was noted that *para*-substituted aromatic compounds were toxic to some bacteria, even at low levels, but a few stimulated growth of individual bacteria. The relationship of chemical structure of biodegradability of DDT analogs was investigated. *Para* substitution of one of the two aromatic rings with chloro, nitro, hydroxyl, or amino groups significantly reduced the rate of biodegradability. The most resistant compounds were those with both rings containing these substituents. Various environmental factors were examined for their effect on DDT metabolism in marine waters. (Author abstract by permission)

76-1001. Courtenay, W. R., Jr.; Roberts, M. H., Jr. (Aquatic Sci. Inc., Boca Raton, FL). **Environmental effects on toxaphene toxicity to selected fishes and crustaceans.** *Natl. Tech. Inform. Serv.*, PB-221 481, 1973, 73 p.

Laboratory studies were conducted to determine lethal limits (96 hr TL50) for toxaphene, salinity, temperature, and dissolved oxygen and their interaction effects on developmental stages of selected warm-temperature and subtropical fishes and crustaceans. Species tested were *Micropterus salmoides* (largemouth bass), *Mugil cephalus* (striped mullet), *Mugil curema* (silver mullet), *Trachinotus carolinus* (pompano), *Callinectes sapidus* (blue crab), *Penaeus duorarum* (pink shrimp), *Sesarma cinereum* (drift line crab), and *Rhithropanopeus harrisii* (mud crab). Histopathological and gross morphological studies were conducted on all early life history stages of the species included. Earliest developmental stages of the fish species treated are more resistant to high levels of salinity, and to low levels of dissolved oxygen, but more sensitive to high temperatures than are later stages. Decapod larvae showed increasing tolerance to toxaphene with increasing developmental age. Synergistic effects between toxaphene and the three environmental factors were

suggested in the species tested. Some histopathology was noted in fry of bass and mullet, and in larvae of *S. cinereum*, *C. sapidus*, and *R. harrisii*. (Author abstract by permission)

76-1002. Morre, D. J. (Dep. Bot. and Plant Pathol., Purdue Univ., West Lafayette, IN). **Brush control along agricultural drainage ditches: environmental safety and efficacy of herbicide formulations.** *Natl. Tech. Inform. Serv.*, PB-237 997, 1974, 108 p. (71 references)

The safety of 2,4-D and related herbicides to man, fish, and aquatic food chain organisms was evaluated. Levels at which aquatic organisms could tolerate the herbicides were determined, and new approaches for evidence as to specific herbicide receptors in fish, algae, and mammals were developed. The three herbicides tested, 2,4-D, dicamba, and picloram, had low toxicity for algae and fish at rates up to maximum solubility in water. A herbicide binding assay developed used indoleacetic acid as a model compound with no evidence of specific binding sites with 2,4-D on membranes prepared from unicellular green algae, fish muscle, or rat liver. A more sensitive electron microscope assay procedure for herbicide-membrane interaction was also developed with indications that animals and algae lack the biochemical mechanisms required for these organisms to respond to 2,4-D or related herbicides. For brush control along agricultural drainage ditches, 2,4-D alone is of limited effectiveness, Silvex as an ester can not be sprayed directly on the water, and application of dicamba appears to be more effective in spring than in the fall. (Author abstract by permission)

76-1003. Rogers, C. J.; Landreth, R. L. (Natl. Environ. Res. Cent., Off. Res. Dev. Environ. Protect. Agency, Cincinnati, OH 45268). **Degradation mechanisms: controlling the bioaccumulation of hazardous materials.** *Natl. Tech. Inform. Serv.*, PB-240 748, 1975, 21 p.

This report delineates the mechanisms which transform hazardous materials such as pesticides and herbicides into toxically active and inactive compounds. A treatment scheme is described which minimizes the release of unwanted materials into the environment. Results of studies on pesticide metabolism in insects have clearly established the importance of hydrolysis, oxidation, reduction, dealkylation, desulfuration, and dehalogenation in the biotransformation of organochlorine, organophosphorus, and carbamate insecticides in insects. Pesticides which are transformed by biological systems include parathion, methyl parathion, DDT, dieldrin, 2,4-D, MCPA, silvex, fenac, dalapon, atrazine, and DCPA. Pesticides are metabolized both by target organisms and by man and other nontarget species. Microsomal drug enzymes in the liver cells protect humans and animals from the effects of foreign chemicals by catalyzing a variety of biotransformation reactions which includes hydroxylation, dealkylation, deamination, alkyl side chain oxidation, hydrolysis, and reduction. The total amount of microsomal enzymes is increased significantly when insecticides such as chlordane, DDT, hexachlorocyclohexane, dieldrin, aldrin, and heptochlor are administered repeatedly to animals. Irradiation with ultraviolet light of the same wavelengths in sunlight has been shown to convert DDT vapors into polychlorinated biphenyls. This is an example of a natural conversion mechanism which produces a transformation product as toxic or more toxic than the parent compound. Bioaccumulation studies have shown that babies having human milk as a sole food source are exposed to a higher dietary insecticide concentration than is the general population. Accumulation of chemicals in a living cell requires that sufficient amounts of the chemical approach the cell membrane and that the membrane allows their entry. If removed from the environment of the cell in time, the foreign chemical cannot cause its toxic effects. Several technologies have been developed which should reduce the impact of toxic and hazardous materials on the environment. The physical state, chemical concentration, and recovery potential of the waste stream determines the most economically feasible processing route. The concentration process includes techniques employing reverse osmosis, ion exchange, activated carbon adsorption, and impoundment. Detoxification is needed to treat those materials that no longer require the toxic element or compound. Detoxification techniques included chemical oxidation/reduction, catalytic, and substitution/transformation processes. Specialized techniques for detoxification include wet oxidation and chlorinolysis.

76-1004. Camper, N. D.; Shively, J. M. (Dep. Bot., Clemson Univ., Clemson, SC). **Effects of selected herbicides on bacterial populations in fresh and treated water.** *Natl. Tech. Inform. Serv.*, PB-240 972, 1974, 10 p. (4 references)

Bacterial populations in untreated and herbicide-treated waters were subjected to three different herbicides. Diuron, dichlobenil, and diquat were added (100 mg/l) to water samples from two fresh water lakes and two herbicide-treated ponds. Total numbers of bacteria were monitored. Bacterial populations in fresh lake water decreased initially after herbicide additions; however, final populations were significantly greater than the controls. Similar observations were recorded for bacteria in dichlobenil- and diuron-treated water. Selective enrichment is implicated by the results of these experiments. (Author abstract by permission)

76-1005. Akitake, H.; Kobayashi, K. (Fish. Sect., Hyogo Prefect., Kobe, Japan). **Studies on the metabolism of chlorophenols in fish. III. Isolation and identification of a conjugated PCP excreted by goldfish.** *Nippon Suisan Gakkaishi (Bull. Jpn. Soc. Sci. Fish.)* 41(3): 321-327; 1975. (15 references)

This paper confirms the excretion of a conjugate PCP (pentachlorophenol) by goldifsh and its isolation and identification. Goldfish were exposed for 24 hr to PCP. In

30 of 100 fish, the amount of PCP was immediately determined. The remainder of the fish were examined at selected times from 4 to 62 hr after being placed in PCP-free water. After 24 hr of exposure, at 0.25 ppm PCP, the concentration of free PCP in the medium decreased to 32% of its initial values. Of the PCP initially present in the medium, 46% was found in the fish. The remainder was not decomposed, but was in bound form in the medium, which along with the 2.3 mg found in the fish corresponded to recovery of almost 100% of the initial quantity of PCP. When the fish were transfered to PCP-free water, the amount of PCP retained in the fish rapidly decreased to half the initial value after 17 hr. The PCP excretion increased with culture time with a corresponding decrease in the levels in fish. Most of the PCP excreted was in bound form and only 10% was found as free PCP. The bound PCP excreted in the medium was a conjugated PCP biosynthesized by the goldfish. Two hundred forty goldfish which had accumulated a total of 158 mg PCP excreted a total of 96.6 mg of conjugated-PCP and 8.4 mg of free-PCP during the 24 hr culture period. From the analytical study, the conjugate excreted by goldfish was identified as pentachlorophenylsulfate, which is the same as that found in the short-necked clam. No other conjugates of PCP were detected. Subsequent work has shown that goldfish also conjugate phenol with sulfate. This suggests that fish possess a detoxication mechanism for various phenolic compounds by sulfate conjugation.

76-1006. Peeples, J. L. (Mississippi Coop. Ext. Serv., Mississippi State, MS 39762). **Microbial activity in benomyl-treated soils.** *Phytopathology* 64(6): 857-860; 1974. (20 references)

Studies were conducted to determine the effect of field applications of benomyl on the number of fungi and bacteria, and the evolution of carbon dioxide in soils. Benomyl was incorporated as a 50% wettable powder into a Kayport silt loam soil at rates of 2.2. and 89.6 kg/ha. Half of the plot was planted with Kentucky bluegrass (turf) which was retreated annually for three years by surface applications at the same rates. The other half was planted each year to soybeans, sugar beets, and squash (crop area) and retreated annually by soil incorporations at the same rates. In additional tests benomyl was surface applied to a Keyport silt loam soil, a Leon Immokalee fine sand soil, and a Cecil sandy loam soil at rates of 2.2 and 22.4 kg/ha, applied both to turf and fallow soil. Despite unexplained variations in microbial population studies, there was no evidence of a trend toward increased or decreased micropopulations due to benomyl treatments. Certain common soil fungi, *Penicillium*, *Aspergillus*, and *Trichoderma* were consistently isolated from benomyl-treated soil. For carbon dioxide evolution studies, turf and fallow soil that had received 2 annual surface applications of benomyl at 2.2 and 22.4 kg/ha was randomly sampled to a depth of 15.2 cm. No differences were noted in carbon dioxide evolved from untreated turf soil and turf soil treated in the lab at 10 μg benomyl/g soil. The amount of carbon dioxide evolved from turf soil treated in the field at 2.2 and 22.4 kg benomyl/ha however, was slightly greater than that evolved from untreated controls. This increased evolution may result from the degradation of benomyl by soil microorganisms. No differences in evolved carbon dioxide were evident from fallow soil. This investigation has revealed that the commonly observed soil fungi and bacteria can tolerate field applications of benomyl. It is suggested that for most soil microorganisms the effects of benomyl are only slight and short-lived.

76-1007. Wainwright, M.; Pugh, G. J. F. (Dep. Bot., Univ. Nottingham, Nottingham England). **Effect of fungicides on the numbers of micro-organisms and frequency of cellulolytic fungi in soils.** *Plant Soil* 43(3): 561-572; 1975. (23 references)

Experiments were conducted to determine what effect a wide range of fungicides would have on the microbiology of soils. The following fungicides were used: captan, dichloran, milcol, and triarimol. A single application of these fungicides caused initial decreases in fungal numbers which, with the exception of the triarimol treatment, were statistically significant. Fungal numbers recovered rapidly in all treated soils and eventually exceeded the numbers in the untreated plots. The most marked increase was noted in triarimol treated soils where fungal numbers were 70% greater than in controls after 58 days. After these initial increases the numbers decreased to near normal values. Changes in the frequency of the major cellulolytic fungi following fungicide treatment were also measured. Those species which showed a general increase in frequency included *Trichoderma koningii*, *Gliocladium roseum*, and *Fusarium culmorum*. Also included were *Penicillium nigricans* and *Penicillium rubrum*. Among those showing a general decrease in frequency following treatment were *Gliomastix murorum* var. *felinum*, *Verticillium* species and *Cheatomium* species. Those which showed frequency changes dependent upon the type of fungicide applied included the *Aspergillus* spp. The numbers of heterotrophic bacteria in laboratory incubated soils generally increased following captan application. These changes were significant only after the two highest concentrations were used. The time at which the peak in numbers of bacteria occurred and their magnitude was dependent on concentration. Fungal numbers, in comparison, decreased with increasing concentration of captan with the most marked effect following the application of captan at 100 μg/g soil, while application at rates below 50 μg/g had no statistically significant effect. In assessing the effect of captan on the numbers of actinomycetes in soil, the only statistically signficant change was an increase in actinomyctes numbers following the application of 25 μg captan/g of soil. The work reported here thus indicates that a single application of the fungicides tested had an effect on the cellulose decomposing fungi. The frequency of the major celluloytic fungal species increased following treatment, suggesting that the short term use of modern fungicides should not adversely effect the rate of leaf litter breakdown in soils.

76-1008. Parrish, P. R. (Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, FL). **Aroclor 1254, DDT and DDD, and dieldrin: accumulation and loss by American oysters (*Crassostrea virginica*) exposed continuously for 56 weeks.** *Proc. Natl. Shellfish. Assoc.* 64: 7; 1973.

Oysters were exposed continuously for a 56 week period to 0.01 μg/l of either Aroclor 1254, *p,p'*-DDT and DDD, or dieldrin. The oyster populations were sampled at 8 week intervals for residues. Based on body weight, maximum concentrations occurred after an 8 wk of exposure, but the maximum concentrations based on absolute amount of toxicant accumulated (μg) occurred after 56 wk of exposure. The average whole-body residues from 5 oysters analyzed after 8 wk were: Aroclor 1254, 1.65 μg/g, 4.0 μg; DDT (plus DDD and DDE), 0.46 μg/g, 1.0 μg; and dieldrin, 0.08 μg/g, 0.2 μg. At the end of the 56 weeks, the residues were: Aroclor 1254, 0.89 μg/g, 25.7 μg; DDT and metabolites, 0.37 μg/g, 7.0 μg; and dieldrin, 0.03 μg/g, 0.6 μg. The three toxicants were similar in their seasonal variations. Residues based on body weight decreased 45-81% in early July and late October. This was apparently a result of spawning. These findings indicate that the life history of oysters must be considered when evaluating residue data from monitoring programs.

76-1009. Petrocelli, S. R.; Anderson, J. W.; Hanks, A. R. (Dep. Biol., Texas A&M Univ., College Station, TX). **Biological magnification of dieldrin in a two part food chain.** *Proc. Natl. Shellfish. Assoc.* 64: 7; 1973.

The possible biological magnification of the chlorinated hydrocarbon insecticide dieldrin was studied in a two member food chain. The food chain consisted of the bivalved mollusk *Rangia cuneata* and the decapod crustacean *Callinectes sapidus*. Dilute solutions of dieldrin were prepared in seawater. The clams were exposed for 36 hr. Sub-samples of clam tissues were then analyzed for residues and the remaining contaminated tissues were fed to blue crabs. Gas-liquid chromatography indicated a magnification factor of 33-35 times ambient water concentration in clam tissue and 3.9-6.8 times clam tissue residue levels in crabs. These results indicate that dieldrin can be accumulated from water by bivalves and concentrated in predator tissues as a result of feeding.

76-1010. Krieger, R. I.; Lee, R. W.; Fahmy, M. A. H.; Chen, M.; Fukuto, T. R. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616). **Metabolism of 2,2-dimethyl-2,3-dihydrobenzofuranyl- 7-*N*-dimethoxyphosphinothioyl-*N*- methylcarbamate in the house fly, rat, and mouse.** *Pestic. Biochem. Physiol.* 6(1): 1-9; 1976. (13 references)

A comparative metabolism study was performed with the dimethoxyphosphinothioyl derivative of carbofuran, 2,2-dimethyl- 2,3-dihydrobenzofuranyl- 7-*N*-dimethoxyphosphino- thioyl-*N*-methylcarbamate (PSC). PSC was metabolized rapidly in female white mice and rats after oral administration at 100 mg/kg. The major route of excretion was the urine. In the mouse, the urine contained 64% of the administered dose after 21 hr, 78% after 24 hr, and 88% after 96 hr. A maximum of 5% of the dose was recovered in the feces during the 96 hr. The total recovery ranged from 93 to 95%. A major fraction of the administered PSC is eliminated in the urine as conjugated hydrolysis products. About 72% of the radioactivity recovered from the mouse was isolated as the phenols of carbofuran, 3-hydroxycarbofuran, and 3-keto-carbofuran. Significant amounts of 3-hydroxycarbofuran and 3-keto-carbofuran were also detected after mild acid hydrolysis; they were evidently contained in the urine as conjugates. The metabolism of PSC was also studied in houseflies treated topically at a dosage of 8 μg/g. Recovery of the applied radioactivity in several experiments ranged from 88 to 95%. PSC was rapidly absorbed by the houseflies. The metabolites recovered from houseflies included: PSC, 17.5%; 3-hydroxycarbofuran, 28.0%; *N*-hydroxymethylcarbofuran, 12.6%; carbofuran, 13.5%; and 3-keto-carbofuran, 7.1%. As the amount of PSC used in this study, even on a molar basis, is much larger than carbofuran levels used in earlies studies, the large quantities of phenolic products from PSC suggest that the dimethoxyphosphinothioyl moiety in PSC provides an opportunity for the rat and mouse to carry out metabolic reactions leading to detoxified products.

76-1011. Karanth, N. G. K.; Bhat, S. G.; Vaidyanathan, C. S.; Vasantharajan, V. N. (Microbiol. Cell Biol. Lab., Indian Inst. Sci., Bangalore 560012, India). ***p*-Dimethylaminobenzenediazo sodium sulfonate (Fenaminosulf)-reductase from *Pseudomonas fragi* Bk$_9$.** *Pestic. Biochem. Phsyiol.* 6(1): 20-29; 1976. (28 references)

The present paper deals with the purification, crystallization, and properties of the enzyme, *p*-dimethylaminobenzenediazo sodium sulfonate reductase, which catalyzes the conversion of *p*-dimethylaminobenzenediazo sodium sulfonate (DABDS) to *N,N*-dimethyl-*p*-phenylenediamine (DMPDA). The homogeneity of the enzyme was ascertained by gel electrophoresis and immunodiffusion studies. The molecular weight was determined by gel filtration as about 87,000. The enzyme was optimally active at pH 7 and 45°C, with an activation energy of 2.5 kcal/mol. NADH, NADPH, and GSH could not function as cofactors, while the enzyme required dithiothreitol as an electron donor. From the Lineweaver-Burk plots, the *K*m values were calculated to be 0.90 and 3.53 m*M* for DABDS and dithiothreitol, respectively. The enzyme demonstrated no requirement for metal ions and was inhibited in varying degrees by different sulfhydryl reagents. As it is known that *N*-methyl *N*-nitroso aniline is a powerful carcinogen, the possibility of DMPDA being converted into a corresponding nitroso compound in soil and its carcinogenicity are being investigated.

76-1012. Zurqiyah, A. A.; Jordan, L. S.; Jolliffe, V. A. (Dep. Plant Sci., Univ. California, Riverside, CA 92502).

Metabolism of isopropyl carbanilate (propham) in alfalfa grown in nutrient solution. *Pestic. Biochem. Physiol.* 6(1): 35-45; 1976. (19 references)

The absorption and metabolism were studied of C^{14}-propham administered to the roots of alfalfa grown in nutrient solution. Seeds were treated with a fungicide, captan, to prevent damping-off of the young seedlings, and germinated in soil. At 5 weeks of age the plants were transferred in groups to three of 125-ml Erlenmeyer flasks containing 125 ml of half-strength Hoagland's solution. Twelve cultures were prepared using 1.5 liters of solution A (0.214 m*M* propham), and 6 additional cultures were prepared using 24 liters of solution B (0.228 m*M* propham). Plants were harvested 8 days after treatment with propham. Results of analyses showed that alfalfa plants absorbed 7.3-14.3% of the propham from the nutrient culture in which they were grown for 8 days. The propham was distributed throughout the shoots and roots, with the shoots containing 76% and the roots 24% of the absorbed radioactivity. Total radioactivity was proportionate to the concentration of propham in the nutrient solution at the beginning of treatment. The nutrient cultures from solution A and B contained 26.9 and 42.4% of the applied radioactivity at the end of the treatment period. The efficiency of extraction of ^{14}C-labeled compounds from plant tissue with aqueous methanol ranged from 70-77% for shoots and 35-38% for roots. Further study allowed the conclusion that hydroxylation and conjugation comprise important transformation processes in the metabolism of propham in alfalfa. There was no evidence for *N*-hydroxylation in the metabolites which were identified in this study. Four aglycones were isolated, three of which were identified as: isopropyl-2- hydroxycarbanilate, isopropyl-4- hydroxycarbanilate, and 1-hydroxy-2- propylcarbanilate. The fourth aglycone was not identified.

76-1013. Lee, S. S.; Fang, S. C.; Freed, V. H. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331). **Effect of DDT on photosynthesis of *Selanastrum capricormutum* [*sic*].** *Pestic. Biochem. Physiol.* 6(1): 46-51; 1976. (29 references)

The effects of DDT were studied on photosynthetic carbon dioxide fixation and the path of carbon in a green alga *Selenastrum capricornutum*. Kinetic studies of photosynthetic carbon dioxide fixation of the treated and untreated algae indicated that DDT at 36 ppb inhibited the incorporation of carbon-14 not only into ethanol-soluble fractions, but also into ethanol-insoluble fraction. The longer the exposure of algae to DDT, the greater inhibition of carbon dioxide fixation. After 3 days of incubation in 36 ppb DDT, incorporation of ^{14}C into aspartic acid was consistently reduced, and incorporation of ^{14}C into glycolic acid was increased. DDT at 3.6 ppb exerted the same effect on the path of carbon fixation. This effect was negligible after 1 day of exposure, more noticeable after 2 days, and became very pronounced after 3 days. The data from this study consistently indicated that in the presence of DDT the increase in incorporation of radioactivity into glycolic acid, a major component of the glycolate pathway, was always accompanied by a decrease of carbon flow into aspartic acid, a major component of the C_4-dicarboxylic acid cycle. This suggests that DDT partly shifts the incorporation of $^{14}CO_2$ from the C_4 pathway of photosynthesis into the pathway of the reductive pentose phosphate cycle. It is concluded from the data of this study that DDT may shift the path of carbon through the inhibition of cyclic photophosphorylation.

76-1014. Frear, D. S.; Swanson, H. R. (Agric. Res. Serv., USDA, Metab. Radiat. Res. Lab., Fargo, ND 58102). **Metabolism of cisanilide (*cis*-2,5-dimethyl-1-pyrrolidinecarboxanilide) by rat liver microsomes.** *Pestic. Biochem. Physiol.* 6(1): 52-57; 1976. (7 references)

Primary oxidation products were isolated and identified from in vitro studies with rat liver microsomes. Initial oxidative reactions of cisanilide metabolism in plants and in rat liver microsomes are compared. Male Sprague-Dawley rats were used in the study. Microsomal activity was associated with a mixed-function oxidase system which required O_2 and NADPH and was inhibited by CO. Two major ether-soluble metabolites were isolated and identified as primary oxidation products: 2-hydroxy-2,5-dimethyl- 1-pyrrolidine carboxanilide and 4′-hydroxy-2,5-dimethyl-1- pyrrolidine carboxanilide. Minor ether-soluble metabolites were also isolated and appeared to be secondary oxidation products formed from the two major metabolites. One of these secondary metabolites appeared to be the dihydroxy product 2,4′-dihydroxy- 2,5-dimethyl-1- pyrrolidine carboxanilide. Crude microsomal preparations also formed small quantities of less than 10% polar metabolites. About 50% of these metabolites were glucuronides as evidenced by enzyme hydroylsis with β-glucuronidase (*Escherichia coli*).

76-1015. Chefurka, W.; Kashi, K. P.; Bond, E. J. (Agric. Canada, Res. Inst., Univ. Sub Post Office, London, Ontario, Canada). **The effect of phosphine on electron transport in mitochondria.** *Pestic. Biochem. Physiol.* 6(1): 65-81; 1976. (62 references)

Data is reported on the site of action of phosphine in the respiratory chain of mitochondria from mouse liver, housefly, and granary weevil. The experiments conducted here confirm the earlier observation that phosphine inhibits the respiratory response of liver mitochondria to ADP. Evidence was also gained that phosphine blocks the transition of state 4 to state 3 in insect mitochondria. The inhibition of state 3 respiration was noted with both DPN-linked substrates, as well as succinate and α-glycerophosphate. In contrast to earlier studies, a concentration as low as 0.11 m*M* phosphine was sufficient to inhibit state 4 of both insect and liver mitochondria. The preferential inhibition of state 3 respiration suggests that phosphine might stabilize a high-energy intermediate by interacting with energy-transfer reactions and thus reimpose respiratory control. It is concluded from various data

that phosphine is an inhibitor of state 3 and state 4 respiratory activity by virtue of its direct inhibition of electron transport due to interaction with cytochrome oxidase. Phosphine was unable to activate the "latent" ATPase and did not cause any inhibition of Mg^{2+}-stimulated ATPase, only high levels (1.1m*M*) showed modest inhibition (41%) of uncoupler-stimulated ATPase. Phosphine had no effect on the ATP-Pi exchange and on the ATP-ADP exchange reaction at concentrations causing strong respiratory inhibition.

76-1016. Kohli, J.; Weisgerber, I.; Klein, W. (Inst. Oekol. Chem., Munich, Germany). **Balance of conversion of ^{14}C-lindane in lettuce in hydroponic culture.** *Pestic. Biochem. Physiol.* 6(1): 91-97; 1976. (30 references)

The balance of total radioactivity was determined after application of ^{14}C-lindane to higher plants in hydroponic culture and to identify, as far as possible, the metabolites. After application of lindane-^{14}C (1.45 ppm) to a nutrient medium containing 12 lettuce plants, a total of 21.9% was recovered after 4 weeks: 7.8% in the nutrient medium and 14.1% in the plants. The remaining radioactivity was probably lost by evaporation. The radioactivity extracted from the nutrient medium consisted of about 82% unchanged lindane, a polar fraction, and a small nonpolar fraction. The polar fraction, constituting 15% of the radioactivity in the extract, contained, first, a group of 2 free phenols, 2,3,4,6-tetrachlorophenol and pentachlorophenol; second, a group of conjugates of pentachlorophenol; and third, a highly hydrophilic substance which was not identified. The nonpolar fraction which constituted 3% of the radioactivity in the extract contained 1,2,3-trichlorobenzene, 1,2,3,4-tetrachlorobenzene, pentachlorobenzene, hexachlorobenzene, β-pentachlorocyclohexane, and another metabolite. This additional metabolite had a molecular weight of 286 and may be a dehydrogenated lindane (hexachlorocyclohexene). The radioactivity extracted from the lettuce plants was due to 77% unchanged lindane, 20% of a polar fraction and about 3% nonpolar compounds. The polar fraction contained a free phenol, 2,3,4,6-tetrachlorophenol; a group of conjugated phenols comprising a tetrachlorophenol and pentachlorophenol; and a highly polar substance which was not identified. The nonpolar fraction contained 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, pentachlorobenzene, β-pentachlorocyclohexane, and hexachlorocyclohexane. Hexachlorobenzene was detected in trace amounts. None of these metabolites could be detected in the blank experiment with nutrient medium that had been in contact with lettuce roots before application for 8 days. Therefore, all these metabolites have been formed by the plants and are not products of abiotic conversions or of microorganisms present at the root surfaces.

76-1017. Solomon, K. E.; Dahlgren, R. B.; Linder, R. L. (South Dakota Coop. Wildl. Res. Unit., South Dakota State Univ., Brookings, SD 57006). **Abnormal embryos in eggs of pheasants given 2,4-D of PCB.** *Proc. S. Dak. Acad. Sci.* 52: 95-99; 1973. (9 references)

The effects of PCBs and pesticides have been studied on pheasants, *Phasianus colchius*. Hens were given, at weekly intervals, gelatin capsules containing 50 mg PCB dissolved in corn oil; 75 or 150 mg technical 2,4-D; 75 or 150 mg Brand A liquid 2,4-D; 75 or 150 mg Brand B liquid 2,4-D; or an empty capsule. PCS (25 mg) was the only compound given to cocks, and these cocks were used to breed hens in the PCB groups. Of the 2,124 fertile eggs incubated from all treatment groups, 43 (2.0%) had embryos with one or more abnormalities of the head or feet. Eighty-one percent of the abnormalities were malformations of the head; 41% involved the maxilla and mandible, 39% the eyes, and 20% the skull. Most of the embryos with multiple head abnormalities (82%) involved the beak and eyes. Abnormalities of the feet were noted in 15% of the deformed embryos; 75% of which had feet turned inward or outward at the distal tibiotarsus, or distal tarsometatarsus, or had single digits turned. One embryo had micromelia and 3 had 4 legs. Three other embryos had unique abnormalities: 1 was small for its age, another was rumpless and had no tongue or esophagus; and a third lacked development of the abdominal wall. Three malpositions of the head were noted. The earliest day of death for an abnormal embryo was 14 days and average day of death was 18 days. Five embryos with abnormalities had pipped the egg but failed to hatch. From the results of these tests it is concluded that none of the treatments had a significant effect on the number of abnormal embryos nor did any treated group have specific reoccurring abnormalities.

76-1018. Kruger, P. J. (Mobile Chem. Co., Edison, NJ). **Bifenox broadleaf herbicide—a status report.** *Proc. S. Weed Sci. Soc.* 27: 161-162; 1974.

Toxicological, fate, and residue data, and 1973 field performance and label registration data are presented for bifenox, methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate. This preemergence herbicide is for use on such crops as corn, soybeans, grain sorghum, small grains, and rice. Oral LD50 for rat and mice is 6400 mg/kg. Dermal LD50 for rabbit is 20,000 mg/kg. Federal hazardous substances test results showed acute inhalation, 200 mg/l; primary eye irritant and primary skin irritant, both negative. Four day TL50 values for trout and bluegills are 1.0 ppm. Eight day LC50 values for beagle dog and pheasant are 5000 ppm. Feeding trials over 90 day periods for rats and beagle dogs showed no abnormalities at dietary levels of 50, 100, and 500 ppm. No potential hazards in the line of mutagenic and teratogenic characteristics have been found. After use on crops, radioactive tracer studies have shown residues in the order of 0.02-0.03 ppm. A negligible tolerance of 0.05 ppm has been established for bifenox in and on soybean and corn. Laboratory metabolism studies showed the compound has a half-life of 5 to 7 days in the soil. The chemical appears largely in plant conjugate form, is unable to translocate, and is not persistent nor does it leach. The

herbicide is effective for 7 to 8 weeks. Chemical and microbiological factors are responsible for the loss of the chemical. Broadleaf control effectiveness has been 65% or more in about 85% of the tests using bifenox alone or in combination with a complementary grass killer. An experimental permit was granted for the use of bifenox as a preemergence broadleaf weed herbicide for use in soybean and field corn. The 2 lb emulsifiable concentrate and 80% wettable powder formulations are included in this permit.

76-1019. Booth, G. M.; Chang, K. M.; Ferrell, D.; Larsen, J. R. (Dep. Zool., Brigham Young Univ., Provo, UT). **Fate and metabolism of BAS 290-H.** *Proc. West. Soc. Weed Sci.* 27: 24-33; 1974. (16 references)

The fate and metabolism of 2-chloro-*N*-(1-methyl-2- propynyl)-acetanilide (290-H, prynachlor) was studied in a model ecosystem. Much of the parent material was metabolized to more polar compounds with varying amounts of 290-H remaining in the water and organisms. The highest percentage of 290-H was 22.8% and was found in water ferns. This indicates that the concentration factors were not completely consistent with the positions of the organisms in the food chains and that 290-H and its metabolites do not bioconcentrate in a manner similar to the classic pollutant DDT. The major pathway of 290-H metabolism in unhydrolyzed water and most organisms including fish, snail, and algae was through 2-hydroxy-*N*-(1-methyl-2- propynyl)- acetanilide (2-OH) to *N*-isobutynyl aniline (IBA). The gammarid metabolized 290-H primarily to an unknown compound. In unhydroylzed water more of the 2-OH was formed, whereas in hydrolyzed water 2-oxo-*N*- (1-methyl-2- propynyl)-acetanilide (2-Oxo) was the major metabolite. The parent herbicide was concentrated 25 times more than any metabolite or unknown compound in fish, 59 times in snail, and 35 times in algae. Salt marsh caterpillars and other aquatic organisms were all alive in the model ecosystem at the end of the experiment, suggesting that either 290-H is not highly toxic or that it can break down to relatively non-toxic components in a short period of time. The data from this study indicates that there is considerable variation between aquatic organisms with regard to their capability to metabolize 290-H. It is concluded that 290-H and its known metabolites do not pose any serious environmental dangers to aquatic food chains under the conditions of this study. The overall data has shown 290-H to have favorable environmental properties. It also appears that the model ecosystem possesses a tremendous potential as a screening tool for determining the biodegradability of new candidate herbicides.

76-1020. McQueen, E. G. (Dep. Clin. Pharamcol., Univ. Otago, Dunedin, New Zealand). **Drug displacement from protein-binding and redistributional interactions.** *Prog. Biochem. Pharmacol.* 9: 122-128; 1974. (13 references)

Organochlorine pesticides retention by the blood was studied in sheep, rats, and one human. High doses of three pesticides, DDT, dieldrin, and lindane, were administered to animals p.o. The human subject ingested DDT, together with a large amount of alcohol, in a suicide attempt. Blood was taken from the animals 24 and 48 hr after dosing. All the pesticides were very highly bound to serum proteins and DDT was the most highly bound. The high degree of protein-binding was associated with an excessively low solubility in water, and this in turn with an exceedingly high lipid-solubility; greatest for DDT and least for lindane. The sera were fractionated on Sephadex G-200 columns. In the sheep, DDT was largely carried on the γ- and α_2-macroglobulins and α_2- and β-lipoproteins. Dieldrin was spread more or less over the protein peaks. Lindane was carried on the albumin. It is suggested that the reasons for these differences in transporting fractions may be a function of the relative degrees of lipid solubility of the three compounds. DDT, being extremely lipid-soluble, travels in the major lipoprotein fraction in the first peak. Lindane is considerably less lipid-soluble and thus tends to travel bonded to the albumin. Dieldrin has intermediate lipid-solubility and intermediate binding characteristics. In the human subject the DDT traveled almost exclusively with the first Sephadex peak, as in the rat. DDT thus does not appear associated with the alpha-lipoprotein in either the rat or man. The possible displacement by phenytoin was studied in sheep which were first given one of the pesticides and then a large dose of phenytoin i.v. A transient rise in serum total DDT levels was induced, rather than the fall which would have been expected had displacement occurred. With dieldrin there was some evidence of displacement. With lindane there was clear evidence of displacement with an apparently significant fall in serum total drug level, and a small corresponding rise in free level. The most likely explanation for the transient rise in total DDT levels was due to an enhancement of activity of hepatic biotransformational enzymes. The results of this study indicate that possible interactions of drugs and pesticides via displacement from protein binding must be kept in mind when therapeutic regimes involving a multiplicity of drugs are in use.

76-1021. Kenaga, E. E. (Dow Chem. USA, Midland, MI 48640). **Use of biological tests for evaluation of pesticides.** *Pure Appl. Chem.* 42(1-2): 285-299; 1976. (31 references)

Biological tests are useful for determining the degree and mode of toxicity of a chemical to specific plants and animals or as bioassays for determining the presence of a toxic residue. Most tests have been done primarily on target pest organisms and secondarily on important non-target species. The test methods used for comparative purposes must be standardized since variations in many parameters of the test methods influence the results. The biological evaluation of pesticides must take into account the susceptibility of various stages in the life cycle of the organism as well as the organisms environment. Enzymatic and other biochemical responses are useful in measuring the nonlethal or sublethal effects of pesticides, as well as subtle morphological or cellular changes such as

teratogenic, mutagenic, or reproductive effects. The mobility and persistence of pesticides or metabolites can be bioassayed to help evaluate leaching, volatility, sorption, residual toxicity, and hydrolysis. The interpretation of simplified laboratory biological tests, while useful, rarely accounts for all the significant variables in field tests since constant changes in organisms and pesticide residue levels occur under natural conditions. It is easy to oversimplify the evaluation of pesticides by use of measurements from biological test methods which are misleading or are wrongly interpreted. Government regulations and test method protocols must be developed which can suitably be used to evaluate the unique biological, physical, and chemical properties and the use pattern of each candidate pesticide. Biological tests are usually most useful when matched by analytical identification and quantification of pesticide residues or metabolites related to environmental or toxicological aspects of the problem being investigated.

76-1022. Martz, F.; Straw, J. A. (Dep. Pharmacol., George Washington Univ. Med. Cent., Washington, DC 20037). **Treatment with *o,p'*-DDD (Mitotane) decreased cytochrome P-450, heme, and microsomal protein content in the dog adrenal cortex in vivo.** *Res. Commun. Chem. Pathol. Pharmacol.* 13(1): 83-92; 1976. (21 references)

Experiments were performed to examine whether *o,p'*-DDD (TDE) inhibits steroidogenesis by decreasing adrenocortical P-450 levels. Mongrel dogs were anesthetized and given 4 mg of dexamethasone phosphate through a cannula placed in the right femoral vein. The left adrenal was removed, and *o,p'*-DDD was infused through the femoral cannula at 0.8 mg/min. Three hours after the infusion ended (total, 60 mg/ml), the right adrenal was removed. Results of these experiments indicated that treatment with *o,p'*-DDD significantly decreased the concentrations of microsomal and mitochondrial P-450 and heme. Also, microsomal protein content was decreased 35% in the treated adrenals. Thus, *o,p'*-DDD treatment reduced total quantities of microsomal P-450 and heme by 55%. Mitochondrial protein concentration was unaffected, so the reductions in total mitochondrial quantities of P-450 and heme were about 30% and 20%, respectively. In some experiments a disappearance of P-450 was noted which could not be explained by its degradation to P-450 but does appear to be related to the loss of adrenal heme. It is suggested that the nature of the non-P-450 heme represents loss of respiratory cytochromes from mitochondria and loss of cytochrome b5 from microsomes. The reduction of microsomal protein, heme, and P-450 content by *o,p'*-DDD can in part explain the drug's suppression of steroidogenesis, as these moieties are essential components of the steroidogenic enzyme pathway. Ultrastructural damage and biochemical lesions appeared rapidly after the administration of *o,p'*-DDD indicating that it is directly destructive towards the adrenal rather than being inhibitory towards biosynthesis of the affected parameters. The mechanism of action of this drug on the adrenals is not clear at present.

76-1023. Khan, M. A. (Res. Stn., Can. Dep. Agric., Lethbridge, Alberta, Canada). **The toxicity of crufomate to calves exposed to warble flies (*Hypoderma* spp).** *Res. Vet. Sci.* 15(2): 180-185; 1973. (28 references)

Experiments were conducted to define the clinical toxicity of crufomate and to determine its effects on whole-blood cholinesterase (ChEs) and the average daily weight gain in young calves treated dermally. One group of calves was treated with an aqueous mixture containing 0.5% crufomate prepared from a commercial formulation of 25% crufomate emulsifiable concentrate. One gallon of this mixture was sprayed on the back, neck, shoulders, side, thighs, and the escutecheon of each calf at a pressure of 21 to 25 kg/cm². The dose of crufomate sprayed on each calf was 150 mg/kg. A second group was treated with a pour-on application of 25% crufomate emulsifiable concentrate. The dose was about 50 mg/kg. The pour-on application caused local irritation. The calves were soon restless and continuously twitching their skins and switching their tails. These signs disappeared within a few min of treatment. After 2 wk, the treated areas were covered with scruf and dandruff which persisted 6 wk and then disappeared. All calves showed signs of toxicosis the day after treatment, including dullness, bloat, shivering, a dry muzzle, absence of remastication, anorexia, excessive discharge from the eyes, nose, and mouth, dyspnea, ruffled haircoat, muscular fasciculation, weakness, and ataxia of the hind limbs. The calves recovered from treatment without any medication within 72 hr after treatment, with the exception of 1 calf in group I which remained sick for 1 wk. From 24 hr to 4 wk after treatment, the ChE activity was lower in both treated groups than in controls. However, at 48 hr and 2 wk after treatment the ChE activity was also reduced in the control group and was not statistically different from the activity in either treated group. There was no significant difference in the degree of ChE inhibition in the 2 treated groups. The maximum inhibition occurred 72 hr after treatment in group I and from 24 hr to 1 wk, with some recovery at 48 hr, in treatment group II. In the two treatment groups the post-treatment ChE activity remained low for 5 wk. Eight weeks after treatment, the ChE activity in the 3 groups slightly exceeded their pretreatment levels. One week after treatment the average daily weight gain was higher in groups I and II than in the control group. But, after the first week, there was no difference among the three groups. At 8 wk after treatment the cumulative weight gain in group II was higher than in controls, but not higher than in group I.

76-1024. Meith-Avcin, N. (Inst. Marine Sci., Univ. North Carolina, Morehead City, NC 28557). **Sublethal effect of DDT on the behavioral responses of barnacles to chemical and tactile stimuli.** *Rev. Intern. Oceanogr. Med.* 33: 91-102; 1974. (23 references)

Some of the effects of sublethal levels were examined of DDT on various aspects of the behavior of the barnacle. Behavioral responses of adult barnacles to chemical solutions and to changes in magnitude of flow

rate were used to study changes in threshold levels of stimulation brought about by sublethal levels of DDT. Additional studies examined the effect of DDT when applied to a glass surface on the ratio of barnacle cyprids prefering rough vs. smooth areas of attachment. The results of these studies showed that sublethal levels of DDT can have a dramatic effect on the barnacle nervous system as evidenced by the anomalous behavior exhibited by adults in response to levels of 0.1 to 10.0 μg/l DDT. It is suggested tht the site of action is sensory rather than the motor or central components of the nervous system. The facts that the effect was seen over a DDT concentration range of three orders of magnitude and that a strong sensory stimulus in the form of a water current overrides this effect support this suggestion. It is suggested that DDT caused the barnacle nervous system to be bombarded by sensory information of one or more modalities, stimulating this effect, and paralleling the effects previously demonstrated electrophysiologically in insects. In settlement experiments it was demonstrated that DDT not only generally inhibits settlement of barnacles, but also tends to inhibit the behavioral preference of barnacles to rough surfaces. The finding that a few DDT-treated plates had a very high density indicates that it is not motor impairment of the cyprids that produced this effect, and that DDT may instead be interfering with the tactile discrimination known to be associated with the highly sensitive settling response.

76-1025. Horinobe, J.; Kashimoto, T. (Osaka Prefect. Inst. Public Health, Osaka, Japan). [**Transfer of β-BHC to nursing mice.**] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 14(6): 635; 1973. (Japanese)

The transfer was studied of β-BHC from mother mice to suckling young through the mothers' milk. The labeled β-BHC was given orally to the mother mice of the ICR strain at 50 μg/day, and BHC accumulation was determined with a scintillation counter. Three different dosing schedules were studied: from 11 days before delivery through one day before delivery, for 3 wk dosage after delivery, and from 11 days before delivery through 3 wk after delivery. The effect of PCB administration in addition to BHC was also studied. More than 90% of the BHC accumulated in the mother mice was transferred to the nursing mice through the mothers' milk. Accumulation of β-BHC in fetal mice could be observed. From 50 to 70% of the BHC administered after birth was readily transferred to the suckling mice. No effect of PCB administration was observed on the BHC transfer to the young mice.

76-1026. Bollag, J. M.; Sjoblad, R. D.; Czaplicki, E. J.; Hoeppel, R. E. (Lab. Soil Microbiol., Dep. Agron., Pennsylvania State Univ., University Park, PA 16802). **Transformation of 1-naphthol by the culture filtrate of *Rhizoctonia praticola*.** *Soil Biol. Biochem.* 8(1): 7-11; 1976. (16 references)

The transformation of 1-naphtol, an intermediate in the decomposition of carbaryl, in the environment was studied for possible toxicological significance. Apparently the fungus *Rhizoctonia praticola* and other species of *Rhizoctonia* form an extracellular enzyme which can transform 1-naphthol. When the culture filtrate of *R. praticola* was incubated with 1-naphthol, a product was formed which was not extractable with benzene or diethyl ether. On chromatographic separation using various Sephadex gels, the product was found to be of high molecular weight probably exceeding 200,000. Boiling the culture filtrate or testing under anaerobic conditions caused loss of activity. Concentration of the filtrate by lyophilization and subsequent fractionation on Sephadex G-150 gave active fractions which converted 1-naphthol to an ether-extractable product indicating the formation of a compound which differs from incubation of 1-naphthol with the untreated culture filtrate. This finding that the culture filtrate eluate from Sephadex G-150 yielded a different product after incubation with 1-naphthol than without Sephadex fractionation demonstrates that several steps are involved in the formation of the high-molecular weight compound.

76-1027. Parr, J. F.; Smith, S. (U.S. Dep. Agric., Baton Rouge, LA). **Degradation of toxaphene in selected anaerobic soil environments** *Soil Sci.* 121(1): 52-57; 1976. (12 references)

The degradation of toxaphene in different anaerobic soil environments was studied, with the extent to which soil microorganisms are involved. Crowley silt loam (pH 6.0) obtained from the Louisiana rice area was used. Toxaphene was applied at a final concentration in soil of 10 ppm. Where moist soil was either unamended or amended with alfalfa meal and incubated in carbon dioxide-free air, little or no toxaphene degraded, and recoveries approached 100% after a period of 6 wk. When moist soil was amended with alfalfa meal, autoclaved, and incubated in nitrogen for 4 weeks, more than 95% of the toxaphene was recovered essentially unchanged. However, when these samples were not autoclaved, degradation was rapid and extensive, with more than 80% of the toxaphene degraded after 4 wks. Soil samples which were flooded and stirred continuously while incubated in nitrogen provided the most active environment for the degradation of toxaphene with more than 95% being degraded within 2 wk. Degradation was equally rapid when unamended soil was flooded and stirred while incubated anaerobically under nitrogen. However, when amended soil was flooded but not stirred, degradation after 6 wk was only 50%. The degradation of toxaphene in the autoclaved-reinoculated systems was delayed about 4 weeks due to initial sterilization prior to reinoculation. This indicates that soil microorganisms present in the inoculum were capable of degrading toxaphene in a steam-sterilized soil incubated under moist anaerobic conditions. The respiratory activity of the soil microflora was considerably greater in the aerobic environment compared with the anaerobic systems. However, this high level of aerobic

respiratory activity resulted in little or no degradation of toxaphene. The rate of toxaphene degradation under soil anaerobiosis increased as the redox potential (Eh) decreased and became very rapid over the Eh range of 0 to -100 mV.

76-1028. Brown, M. A.; Maniscalco, V. J. (Sam Houston State Univ., Huntsville, TX). **Effects on milk production and internal parasites of dairy cattle from a ration supplemented with a parasiticide.** *Southwest. Vet.* 27(1): 51-53; 1974. (4 references)

A trial involving 36 lactating dairy cattle of Holstein, Jersey, and Brown Swiss breeds was undertaken to test the effectiveness of Baymix Crumbles (containing 0.32% coumaphos) in reducing internal parasites and increasing milk production in animals treated with this parasiticide. During the trial all animals were fed a complete ration. Half of the cows were fed a daily supplement of one ounce/100 lb/day by Baymix Crumbles for 6 consecutive days. The mixture contained 0.32% coumaphos, and provided a daily dose of 2 mg of coumaphos/kg. At the beginning of the trial, all dairy females were infested with internal parasites. At the conclusion, the 18 untreated cows still were passing parasite eggs in the feces. Among the treated females, however, 14 appeared completely rid of parasite eggs and the remaining 4 had only a few eggs. Use of the parasiticide resulted in total eradication of internal parasites in 78% of the treated animals and reduced parasite populations markedly in the remaining 22%. No ill effects during supplemented Baymix feeding were noted. The milk production rose an average of 3.7 lb/cow/day by the end of the 6 day treatment period. A month following the single period of treatment for internal parasites, milk production levels of treated cows had fallen to levels in the untreated individuals. The results of this study support the recommendations from earlier trials that two treatments with a coumaphos parasiticide given at 2 to 3 month intervals are needed to produce a lasting increase in milk production.

76-1029. Nisbet, I. C. T. (Author address not given). **Ecological magnification.** *Technol. Rev.* 77(5): 6-7,68; 1975.

In monitoring persistent chlorinated hydrocarbons, a commonplace observation is that residue concentrations are much higher in predatory animals than in other organisms or in the general environment. The principal force behind the phenomenon of ecological magnification appears to be the partitioning of the chemicals between water and fat-containing organisms. The less soluble the chemicals are in water, the more strongly they are taken up into plants and animals. However, a simple partitioning theory does not work quantitatively. The degree of accumulation appears to be limited by biological rather than physico-chemical processes. An equilibrium theory has been proposed for describing accumulation, but is not entirely satisfactory. In man, although tissue levels of DDT appear to have reached equilibrium some years ago, those of DDE rise constantly with age. This is hard to reconcile with the equilibrium theory. Laboratory studies now seem to grossly understimate the potential for ecological magnification in the natural environment. The selective exposure of predatory animals to poisoning is one factor contributing to these anomalies. Selective exposure is a particular hazard to scavenging animals, which eat meat or moribund prey, and are thus in danger of selecting poisoned individuals.

76-1030. Ruddick, J. A.; Williams, D. T.; Herlihy, L.; Khera, K. S. (Health Protect. Br., Bur. Chem. Safety, Food Directorate, Tunney's Pasture, Ottawa, Ontario K1AOL2, Canada). **^{14}C-Ethylenethiourea: distribution, excretion, and metabolism in pregnant rats.** *Teratology* 13(11): 35-40; 1976. (15 references)

Following administration of single oral doses of [^{14}C] ethylenethiourea (ETU) to pregnant rats maternal blood maintained peak radioactivity for 2 hr, and the radioactivity was dispersed uniformly between the red blood cells and plasma. The level of radioactivity was distributed equally among several maternal tissues but was present in lower amounts in embryos. Twenty-four hours after treatment all tissues examined, except blood, were relatively clear of radioactivity and 72.8% of the total radioactivity given had been excreted in the urine. Elution patterns of metabolites from Sephadex separation suggested that ethylenethiourea was degraded very little. The teratological mechanism is discussed. (Author abstract by permission)

76-1031. Sherman, H.; Kaplan, A. M. (Cent. Res. Dev. Dep., Haskell Lab. Toxicol. Ind. Med., E. I. du Pont de Nemours Co. Inc., Newark, DE 19711). **Toxicity studies with 5-bromo-3-*sec*-butyl-6-methyluracil.** *Toxicol. Appl. Pharmacol.* 34(2): 189-196; 1975. (19 references)

The herbicide, 5-bromo-3-*sec*-butyl-6-methyluracil (bromacil) exhibited a low order of acute toxicity as evaluated by oral, dermal, and inhalation studies in mammals and by fish and wildlife studies. Bromacil fed to pregnant New Zealand white rabbits on days 8—16 of gestation at dietary levels of 0, 50, and 250 ppm was not teratogenic. In a three-generation six-liter reproduction study with rats, a dietary level of 250 ppm had no adverse effects upon reproduction and lactation performance; no pathologic changes were observed in weanling pups of the F$_{3b}$ generation. Rats of both sexes were fed nutritionally complete diets containing 0, 50, 250, and 1250 ppm bromacil for 2 hr. Except for a lower food efficiency among the female rats that received 1250 ppm bromacil, there was no nutritional, clinical, hematologic, urinary, or biochemical evidence of toxicity, nor any evidence of carcinogenicity; there was, however, a suggestion of slight hyperplasia in the thyroids of animals given the highest dietary level. Beagle dogs of both sexes, 1-2 yr of age, fed nutritionally complete diets containing 0, 50, 250, and 1250 ppm

bromacil for 2 yr, showed no nutritional, clinical, hematological, urinary, biochemical, or pathologic evidence of toxicity. (Author abstract by permission)

76-1032. Petrella, V. J.; Fox, J. P.; Webb, R. E. (U.S. Army Med. Res. Inst. Infect. Dis., Phys. Sci. Div., Fort Detrick, Frederick, MD). **Endrin metabolism in endrin-susceptible and -resistant strains of pine mice.** *Toxicol. Appl. Pharmacol.* 34(2): 283-291; 1975. (10 references)

Distribution of endrin and its metabolites in vivo was measured in order to determine whether differences in toxicity between a resistant (R) strain of pine mouse as opposed to a susceptible (S) strain might be attributed to differences in metabolism of endrin. One of the metabolites recovered was also produced upon incubation with a liver microsomal fraction prepared from the S strain. [^{14}C]Endrin was administered to both strains of animals orally at 0.5 mg/kg. Total recovery of ^{14}C in both feces and urine was 76% for the R strain and 53% for the S strain. Feces and urine were extracted and metabolites separated chromatographically. Both strains produced a single major fecal metabolite, F-1. Three urinary metabolites, U-1, U-2, and U-3, were produced by the S strain while only two metabolites, U-1 and U-2, were identified in urine of the R strain. The fecal metabolite, F-1, and urinary metabolite, U-2, were chromatographically identical. The recovery of F-1 and ether-soluble U-2 for the R strain was 47.9% while that for the S strain was 23.2%. Endrin was metabolized by hepatic microsomes of both strains in vitro to a compound, L-1, that was chromatographically identical to F-1 and U-2. Production of L-1 by microsomes was dependent upon NADPH. The rate of formation of L-1 in vitro by the R strain was greater than the S strain. The apparent *K*m for the L-1 production from endrin was less than 20 μM. (Author abstract by permission)

76-1033. Gallo, M. A.; Bachmann, E.; Golberg, L. (Inst. Compar. Toxicol., Albany Med. Coll., Albany, NY 12208). **Mitochondrial effects of 2,6-dichloro-4-nitroaniline and its metabolites.** *Toxicol. Appl. Pharmacol.* 35(1): 51-61; 1976. (18 references)

The effects of 2,6-dichloro-4- nitroaniline (DCNA) and its primary mammalian metabolites 3,5-dichloro-4-aminophenol (DCAP) and 2,6-dichloro-*p*-phenylenediamine (DCPD) were studied on isolated rat liver mitochondria in vitro and ex vivo. DCNA and DCAP inhibited electron transport and uncoupled oxidative phosphorylation in vitro at 10 μM while DCPD produced only slight uncoupling at 0.2 mM. Ex vivo studies at 1000 mg/kg p.o. or 500 mg/kg p.o. revealed a slight increase in respiratory rate and an increased sedimentation coefficient of isolated mitochondria. Urine analysis indicated two pathways of DCNA metabolism in the rat, but interconversion of DCPD to DCAP could not be demonstrated. (Author abstract by permission)

76-1034. Teichert, K.; Szymczyk, T.; Consolo, S.; Ladinsky, H. (Dep. Biochem., Inst. Biopharm., Acad. Med., Warsaw, Poland). **Effect of acute and chronic treatment with dichlorvos on rat brain cholinergic parameters.** *Toxicol. Appl. Pharmacol.* 35(1): 77-81; 1976. (12 references)

The activity of acetylcholinesterase in rat brain was decreased by 70% 1 hr after oral administration of dichlorvos (DDVP, *O*,*O*-dimethyl- *O*-2,2-dichlorovinylphosphate) in a dose corresponding to 50% LD50; after 14 days of administration of 5% LD50, the activity decreased by 45%. In neither case was the activity of whole brain choline acetyltransferase or the contents of acetylcholine and choline altered. However, in the cerebral hemispheres, and especially the corpus striatum, acetylcholine was considerably increased without a concomitant change in choline. (Author abstract by permission)

76-1035. Short, R. D., Jr.; Russel, J. Q.; Minor, J. L.; Lee, C. C. (Pharmacol. Toxicol., Midwest Res. Inst., Kansas City, MO 64110). **Developmental toxicity of ferric dimethyldithiocarbamate and bis(dimethylthiocarbamoyl) disulfide in rats and mice.** *Toxicol. Appl. Pharmacol.* 35(1): 83-94; 1976. (14 references)

Ferric dimethyldithiocarbamate (ferbam) and bis(dimethylthio carbamoyl) disulfide (thiram) are agriculturally important fungicides. The effect of these compounds on development was studied during gametogenesis in rats, organogenesis in rats and mice, and the peri- and postnatal period in rats. Ferbam administered in the diet to rats prior to mating did not affect reproduction in either males after at least 13 weeks of daily doses as high as 109 mg/kg or females after at least 14 days of daily doses as high as 51 mg/kg. Thiram, given during similar periods, produced infertility in male rats at doses of 132 mg/kg and delayed the female estrous cycle at doses of 96 mg/kg. Ferbam administered to rats during organogenesis by gavage at doses of 114 mg/kg reduced the maternal weight gain, litter size, and fetal body weight. Mice survived ferbam treatment during gestation at doses of 228 mg/kg without adverse effects on these parameters. Thiram treatment during organogenesis reduced maternal weight gain and fetal body weight in rats given 40 mg/kg or more. Litter size was decreased in rats given thiram at doses of 136 mg/kg or more. Some mice died at thiram doses of 300 mg/kg; however, development was not affected in the survivors. These fungicides were judged to have little teratogenic activity. The administration of ferbam at 0.15% and thiram at 0.10% of the diet during the peri- and postnatal period reduced the growth and survival of pups. These effects were reversed by cross-fostering. Since ferbam and thiram interfered with reproduction only at doses that produced toxicity in the adult, these compounds were judged to have little primary effect on reproduction. (Author abstract by permission)

76-1036. Bell, J. U.; Hansell, M. M.; Ecobichon, D. J. (Dep. Pharmacol. Anat., Dalhousie Univ., Halifax, Nova

Scotia, Canada). **The influence of DDT on the ontogenesis on drug-metabolizing enzymes in the perinatal rat.** *Toxicol. Appl. Pharmacol.* 35(1): 165-177; 1976. (32 references)

DDT (*p,p'*-isomer, 50 mg/kg) was administered orally for 3 consecutive days to pregnant or lactating rats at different pre- and postnatal stages. The dams, fetuses, and pups were killed 24 hr after the last dose. Hepatic *p*-nitroanisole *O*-demethylase (OD), carboxylesterase (CE), and sulfobromophthalein-glutathione (BSP-GSH) conjugating-enzyme activities in 12,000 *g*, 20-min supernate of a 20% (w/v) liver homogenate were measured. The developing rat liver was examined by electron microscopy. Tissue residues of *p,p'*-DDT and two metabolites (*p,p'*-DDD and *p,p'*-DDE) were quantitated by gas-liquid chromatography. A good correlation was observed between tissue insecticide residues and the morphological and biochemical changes. The low levels of residues received transplacentally before term or 3 days prepartum had no effect on either ultrastructural appearance or on the drug-metabolizing enzymes. Hepatocytes from experimental pups 4 days old and older showed high tissue concentrations of insecticide accompanying marked increases in the smooth endoplasmic reticulum and in the enzymes studied. Twofold increases in hepatic OD were observed in pups as early as 4 days after birth. While statistically significant, DDT-related increases in CE and BSP-GSH conjugating-enzyme activities were not as large. Membrane arrays were prominent in hepatocytes of 4-day-old pups concomitant with extremely high concentrations of DDT. (Author abstract by permission)

76-1037. Bell, J. U.; Van Petten, G. R. (Div. Pharmacol. Ther., Fac. Med., Univ. Calgary, Calgary, Alberta T2N IN4, Canada). **Characterization of maternal and fetal ovine plasma cholinesterase.** *Toxicol. Appl. Pharmacol.* 35(1): 147-155; 1976. (16 references)

Cholinesterase of maternal and fetal ovine plasma, obtained at 112-115 days of gestation, has been characterized and compared by using various techniques including statistical evaluation of kinetic parameters when using acetyl-, propionyl-, and butyrylthiocholine, gel filtration, polyacrylamide-gel electrophoresis, and sensitivity to various inhibitors. Hydrolysis of acetylthiocholine, the optimum substrate, was found to be two to three times faster in fetal plasma than in maternal plasma, although the Michaelis constants did not differ. In both maternal and fetal plasma, gel filtration yielded a major and a minor peak of cholinesterase activity, whereas electrophoresis yielded six bands of activity, including three major bands. These findings suggested quantitative rather than qualitative differences between the maternal and fetal activity. Despite the quantitative differences, there was no difference in the maternal and fetal cholinesterase sensitivity to inhibition by eserine, diisopropylfluorophosphate, and dichlorvos. (Author abstract by permission)

76-1038. Lake, B. G.; Longland, . C.; Gangolli, S. D.; Lloyd, A. G. (Br. Ind. Biol. Res. Assoc., Carshalton, Surrey SM5 4DS, England). **The influence of some foreign compounds on hepatic xenobiotic metabolism and the urinary excretion of D-glucuronic acid metabolites in the rat.** *Toxicol. Appl. Pharmacol.* 35(1): 113-122; 1976. (26 references)

A gas-liquid chromatographic method has been developed for the determination of some D-glucuronic acid metabolites in rat urine. A sequential study was conducted on the effect of sodium phenobarbital (PB) treatment and subsequent reversal of a number of parameters of hepatic xenobiotic metabolism and the urinary excretion of some metabolites of the D-glucuronic acid pathway. A good correlation was obtained between the levels of activity of hepatic microsomal xenobiotic metabolizing enzymes and the urinary excretion of L-gulonic, D-glucaric, and D-glucuronic acids. Studies were also conducted with 20-methylcholanthrene (MC), dichlorodiphenyltrichloroethane (DDT), pregnenolone-16α-carbonitrile (PCN), and butylated hydroxytoluene (BHT). All of these agents enhanced hepatic microsomal xenobiotic-metabolizing enzymes and the urinary excretion of some metabolites of the D-glucuronic acid pathway. For example, the urinary excretion of D-glucaric and L-gulonic acids was enhanced by PB and MC treatments, but the former remained unaffected by the administration of either DDT, PCN, or BHT. Furthermore, none of the other urinary indices measured, namely, D-glucuronic acid, L-gulonic acid, L-ascorbic acid, and xylitol, was consistently enhanced by all five agents studied. However, when the urinary concentrations of the D-glucuronic acid metabolites were summated, significant increases in the total urinary excretion of the metabolies were observed with all compounds. The results suggest that in order to obtain a valid urinary index of the induction of hepatic xenobiotic-metabolizing enzymes in the rat it is necessary to measure a spectrum of metabolites of the D-glucuronic acid pathway. (Author abstract by permission)

76-1039. Joy, R. M. (Dep. Physiol. Sci., Univ. California Sch. Ved. Med., Davis, CA 95616). **Convulsive properties of chlorinated hydrocarbon insecticides in the cat central nervous system.** *Toxicol. Appl. Pharmacol.* 35(1): 95-106; 1976. (24 references)

The convulsive properties of subgroups of chlorinated hydrocarbon insecticides were compared in locally anesthetized, paralyzed cats. Dieldrin, endrin, and lindane proved to be rapidly acting, potent convulsants. They produced indistinguishable changes in EEG and evoked-response studies. Hypersynchrony, rhythmic bursts of spikes and waves, and isolated spikes characterized the preictal state. Seizures were of a generalized tonic-clonic type. Responses in sensory and motor cortex to sensory nerve stimulation were enhanced three- to fivefold. Aldrin and hepatchlor produced similar effects but only after a delay of 20-30 min and at two to three times higher doses. DDT effects were more variable. Although it produced convulsive behavior, EEG effects differed, being charac-

terized by sustained hypersynchrony. Responses to sensory nerve stimulation were usually, but not always, enhanced. Kelthane produced no measurable effects on EEG or evoked responses at all doses below those causing death by cardiovascular collapse. This data demonstrates that the epoxide compounds (dieldrin and aldrin) and lindane are directly toxic to the mammalian CNS and do not require metabolism to an active metabolite. Second, for the cyclodienes the epoxides are more potent and more rapid in development of effects than are the nonepoxide analogs. (Author abstract by permission)

76-1040. Bushnell, J. H.; Rao, K. S. (Dep. Environ., Population, Organismic Biol., Univ. Colorado, Boulder, CO 80302). **Dormant or quiescent stages and structures among the ectoprocta: physical and chemical factors affecting viability and germination of statoblasts.** *Trans. Am. Microsc. Soc.* 93(4): 524-543; 1974. (45 references)

The viability of statoblasts of certain species of *Plumatella* was investigated after exposure to various pollutants. Toxaphene was one organochlorine pesticide tested. *P. casmiana* statoblasts exposed for 30 days to as much as 5.0 mg/l toxaphene, dried, and then placed in fresh culture water exhibited nearly the same number of germinations as did controls during 14 days of observation. Zooids all died immediately at this concentration. Their longevity was even further reduced when cultured in concentrations of 0.0005 mg/l. Statoblasts exhibited a similar resistance after storage for one week in a 10 mg/l culture solution of the herbicide 2,4-D butyl ester.

76-1041. Hiltibran, R. C. (Illinois Nat. Hist. Surv., Urbana, IL). **Oxygen and phosphate metabolism of bluegill liver mitochondria in the presence of some insecticides.** *Trans. Ill. State Acad. Sci.* 67(2): 228-237; 1974. (34 references)

The effects of various insecticides on energy production by bluegill, *Lepomis macrochirus*, liver mitochondria have been investigated. The studies were made in the presence of succinate and α-ketoglutarate as substrates. The organochlorine insecticide dieldrin and the carbamate insecticide carbofuran did not alter the oxygen or phosphate uptake in the presence of either substrate. The remaining organochlorine insecticides, aldrin, chlordane, DDE, endrin, heptachlor, kepone (chlordecone), lindane, methoxychlor, and toxaphene, at a level of 0.1 mg/ml, altered oxygen uptake to various extents ranging from 25% inhibition for aldrin to 87% inhibition in the presence of heptachlor. The organochlorine insecticides did not alter phosphate uptake in the presence of succinate. All the organophosphate insecticides, dasanit (fensulfothion), diazinon, malathion, parathion, and thimet (phorate), inhibited oxygen uptake. The inhibition of oxygen uptake by bluegill liver mitochondria was more severe in the presence of organophosphate insecticides than in the presence of organochlorine insecticides. Phosphate uptake in the presence of succinate was not altered in the presence of organophosphate insecticides. Sevin (carbaryl) inhibited oxygen uptake 35% and was the only carbamate insecticide to alter either oxygen or phosphate uptake in the presence of either substrate. Chlordane and hepatchlor inhibited oxygen uptake by bluegill liver mitochondria 39 and 29%, respectively, in the presence of α-ketoglutarate. No effect on phosphate uptake was noted. Lindane did not change oxygen uptake but decreasee the uptake of phosphate. Methoxychlor increased oxygen uptake. The other organochlorine insecticides did not alter either oxygen or phosphate uptake by the bluegill liver mitochondria. Diazinon, malathion, and thimet inhibited oxygen uptake by 60% for thimet to 88% for diazinon. Dasanit and parathion did not alter either oxygen or phosphate uptake. Carbofuran and sevin did not change oxygen or phosphate uptake in the presence of α-ketoglutarate.

76-1042. Shtenberg, A. I.; Khovaeva, L. A. (Lab. Pestic. Toxicol., Inst. Nutr. Acad. Med. Sci. USSR, Moscow, USSR). **Immunodepressornoe deystvie nekotorykh pestitsidov pri raznykh usloviyakh pitaniya zhivotnykh. [Immunodepressant action of some pesticides with different conditions of the animal feeding.]** *Vop. Pitan.* (5): 61-68; 1975. (31 references) (Russian)

Experiments are reviewed on the effects of small oral doses of pesticides on the immune status of rats kept on normal diet or under food deprivation conditions. Considerable reduction of the agglutinin titer was observed after the prolonged administration of trichlorfon and metaphos (methyl parathion, 5% LD50); carbaryl (2-5 mg/kg), zineb, ziram, and maneb. Relative to the control, the rise in the hemagglutinin and hemolysin titers at the end of the experiment was retarded in rats fed 5 mg/kg doses of trichlorfon or 7 mg/kg doses of methylnitrophos (fenitrothion), especially after prolonged starvation. Starvation for 20 days with simultaneous oral administration of pesticides caused a considerable slow-down in the rise of the serum antibody titer in animals that had been kept on an optimal diet before starvation, but it stimulated the antibody formation in rats kept on a low-protein diet. In animals fed pesticides, the reduction of the complement titer appears at a later date than the drop in the antibody titer. Pesticides were found to prevent the transformation of undifferentiated lymphoid cells into immunocompetent ones. The findings indicate high susceptibility of the immune system, and especially of antibody formation, to even small doses of pesticides.

76-1043. Lagier, R. F.; Johansen, C. A.; Kleinschmidt, M. G.; Butler, L. I.; McDonough, L. M.; Jackson, D. S. (Tree Fruit Res. Cent., Wenatchee, WA 98801). **Adjuvants decrease insecticide hazard to honey bees.** *Wash. Agric. Exp. Stn. Bull.* 801: 1-7; 1974. (19 references)

A bioassay technique was investigated for screening insecticide residues for toxicity to honey bees, *Apis mellifera* L. Carbaryl and parathion formulations as well

as mixtures with several adjuvants were screened. Although several additives decreased the mortality of these insecticides, none was safe enough to justify recommendation. Analysis of residues from several formulations of carbaryl used to trea. alfalfa foliage showed roughly equal residue distributions among the surface, in the waxy coating, or within the remaining tissues. In comparison testing of a flowable suspension of carbaryl in oil applied ULV against malathion ULV for effectiveness against grasshoppers, a comparison was also made of the hazards to colonies of honey bees against that presented by using a carbaryl wettable powder. Results of this study indicate that application of carbaryl in oil had a much shorter residual hazard to bees than did the wettable powder. Grasshopper kill reached 80% mortality after 30 days. Although carbaryl in oil destroyed about half the foraging bees at first, mortality did not persist. The treated colonies appeared as strong as the controls by the end of the season. This represents a considerable decrease in hazard as compared to malathion ULV or carbaryl wettable powder or dust formulations. In some tests honey bees were caged on samples of Russian Knapweed, *Centaurea repens*, containing carbaryl in oil residues from the main plot. Bee kill from the wettable powder residues was much greater than from the ULV residues. Samples of Russian knapweed and cheatgrass, *Bromus tectorum*, foliage were analyzed to determine the longevity of carbaryl ULV residues. The half-life was 25 days on Russian knapweed and 15 days on cheatgrass. The persistent residues of carbaryl did not kill bees, but they did control grasshoppers.

76-1044. Wichman, J. R.; Byrnes, W. R. (Dep. For. Nat. Resour., Purdue Univ., West Lafeyette, IN 47907). **Uptake, distribution, and degradation of simazine by black walnut and yellowpoplar seedlings.** *Weed Sci.* 23(6): 448-453; 1975. (7 references)

One-year-old and 3-month-old black walnut (*Juglans nigra* L.) and yellowpoplar (*Liriodendron tulipifera* L.) seedlings were treated with ring-labeled ^{14}C-simazine [2-chloro-4,6-bis(ethylamino)- *s*-triazine] in nutrient culture. Simazine uptake was measured and the levels of simazine and its degradation products monitored at 3, 6, and 9 days following treatment for 1-year-old seedlings and at 3, 8, and 13 days for 3-month-old seedlings. Concentrations of simazine and the phytotoxic degradation product monodealkylated simazine [2-chloro- 4-amino-6-(ethylamino-*s*- triazine] were significantly higher in yellowpoplar than in black walnut leaves. For 1-year-old seedlings, higher concentrations of phytotoxic compounds in yellowpoplar than in black walnut were attributed to greater simazine degradation by black walnut. For 3-month-old seedlings, higher concentrations in yellowpoplar were attributed to greater simazine uptake by yellowpoplar and greater degradation in black walnut. Simazine degradation proceeded rapidly in both species and *N*-dealkylation was a major pathway. Monodealkylated simazine and 2-chloro-4,6- diamino-*s*-triazine were isolated from various tissues of black walnut and yellowpoplar. Hydroxysimazine [2-hydroxy- 4,6-bis(ethylamino)- *s*-triazine] was found in yellowpoplar roots but not in any black walnut extracts. Two other degradation products were isolated but not identified. (Author abstract by permission)

76-1045. David, D. (Lab. Biol. Anim., Univ. Clermont, Aubiere, France). **Germ cell population of chick and quail embryos from DDT treated eggs.** *Wilhelm Roux's Arch. Dev. Biol.* 178: 215-223; 1975. (13 references)

The effects of DDT treatment were studied on chick and quail eggs. The eggs were treated for 30 sec before incubation with diluted aqueous suspensions of commercial DDT. The germ cell population of the treated embryos increased progressively during the early stages of development. This germ cell population was only slightly lower than in the controls. For each stage of development, the difference between the number of germ cells in controls and embryos contaminated by DDT was not statistically significant. In order to exert its sterilizing effect on the germ cells, DDT must be administered before the beginning of incubation. At later stages, when the gonocytes have colonized the gonads, the germ deficit becomes significant.

See also **76-0851** **76-0859**

76-1046. Mailath, F.; Medve, F.; Morik, J. (Inst. Pub. Health, Debrecen Med. Univ., Debrecen, Hungary). **Nehany fungicid vegyulet vekonyreteg-kromatografias kimutatasa es kvantitativ meghatarozasa. [Thin-layer chromatographic identification and determination of fungicides.]** *Acta Pharm. Hung.* 44(1-2): 71-74; 1974. (2 references) (Hungarian)

Thin-layer chromatographic methods and general recommendations for the qualitative and quantitative determination of certain fungicides are given. Ligroin, cyclohexane, carbon tetrachloride, toluene, benzene, chloroform, ether, ethylacetate, acetone, butanol, ethanol, and methanol are suitable as solvents. Sodium fluorescein in 50% methanol, a 1 : 1 mixture of 0.1 *N* potassium permanganate and 2 *N* acetic acid, a 1% iodine solution in methanol, a 0.5% solution of rhodamine B in ethanol, and Dragendorff's reagent can be used for color development. Silica gel G is used for identification, after which absorption spectrophotometry is used for quantitative determination after elution.

76-1047. Karlhuber, B. A.; Hoermann, W. D.; Ramsteiner, K. A. (Ciba-Geigy Ltd., Agrochemicals Div., Basle, Switzerland). **Pesticide residue analysis by mass fragmentography.** *Anal. Chem.* 47(14): 2450-2452; 1975. (6 references)

The application of gas chromatography-mass fragmentography to problems in pesticide residue analysis was studied. The linear dynamic range of the gas chromatograph-mass spectrometer was checked using standard solutions of atrazine ranging from 100 pg to 100 ng. The coefficient of correlation was 0.9991, and the slope and intercept of the regression line for the base peak, m/e 200, were 1.2 and 0.24 cm, respectively. The relative standard deviation from 11 replicate injections of 1 ng atrazine was +3%. Ten ng of terbuthylazine and GS26571 (2-amino -4- *tertbutyl amino-6-methoxy -s-* triazine) were easily determined although the gas chromatographic retention times were identical, demonstrating the selectivity of the mass fragmentographic detector. Use of the mass spectrometer as a GLC detector was mandatory for the determination of 2-methoxyethanol in olive products, though no specific GLC-detector normally used in residue analysis provided satisfactory results. The gas chromatograph-mass spectrometer also proved superior to conventional gas chromatography for the determination of bromofenoxim residues in hops and the examination of apparent atrazine residues in sewage water.

76-1048. Farwell, S. O.; Bowes, F. W.; Adams, D. F. (Air Pollution Res., Washington State Univ., Pullman, WA 99163). **Determination of chlorophenoxy herbicides in air by gas chromatography/mass spectrometry: selective ion monitoring.** *Anal. Chem.* 48(2): 420-426; 1976. (33 references)

The electron-impact mass spectra for the chlorophenoxy family of herbicides were obtained and examined for the characteristic fragment ions. These mass ions were then used to establish selective ion monitoring techniques for the specific analysis of airborne 2,4-D compounds. A separate diffusion pump for the ion source of the quadropole mass spectrometer allowed a direct interface between the gas chromatograph and the mass spectrometer; thus, the total gas chromatographic effluent flowed into the ion source. This total effluent GC/MS system proved advantageous for environmental analysis, providing maximum sensitivity and reproducibility. For example, if the base peak in the mass spectra of the chlorinated herbicides is monitored continuously, then the detection limit is in the 1-0.1 pg range. In practice, routine air samples were analyzed for 2,4-D butyl ester down to the 1-pg level. Data are also presented for a comparison study between GC/ECD-^{3}H, GC/ECD-^{63}Ni, and GC/MS-SID quantitative results.

76-1049. Pungor, E.; Toth, K.; Feher, Z.; Nagy, G.; Varadi, M. (Inst. Gen. Anal. Chem., Tech. Univ., Budapest, Hungary). **Application of electroanalytical detectors in chromatography.** *Anal. Lett.* 8(12): 9-23; 1975. (42 references)

One of the main problems in chromatography involves the detector. Today the development and application of selective detectors has come into prominence. The extensive development of electroanalysis in the sixties makes the use of electroanalytical detection in chromatography more and more feasible. This development can be noted in 2 main fields: in potentiometry and in voltammetry. Methods have been developed which apply ion-selective electrodes and voltammetric detectors. The main difficulty in applying electrochemical sensors in gas chromatographic detectors is that the gaseous eluate at high temperature must be brought continuously, without tailing, and, if possible, quantitatively, into the liquid phase. In the case of potentiometric detectors, an additional problem lies in the fact that the fundamental potentiometric electrodes which are available in increasing quantity and high quality are suitable primarily for the detection of ionic inorganic compounds. Thus, the gas chromatographic separation products can be potentiometrically detected only after appropriate transformation of these products. With the appearance of sensitized potentiometric electrodes, further possible applications of potentiometric detectors in gas chromatography exist. It is anticipated that gas-sensing electrodes will soon find application as gas chromatographic detectors. Enzyme electrodes can successfully be applied to the selective determination of numerous biologically important compounds such as amino acids and sugars. There are two major problems in the use of ion-selective electrodes in liquid chromatography. First, few applications of such electrodes are possible in non-aqueous solutions. Secondly, the transformation of the organic material into an ionic inorganic component is more difficult to effect than in gas chromatography. Today's efforts are directed toward solving the problems of the sensitive detection required by chromatography

using special detector cells. Further progress in this field can be expected due to the development and application of voltammetric electrodes of better electrochemical behavior and detector cells of higher sensitivity, as well as from the wider use of already known selective voltammetric methods of high sensitivity, such as square wave and pulse polarography.

76-1050. Franke, J. P.; Coenegracht, P. M. J.; de Zeeuw, R. A. (Lab. Pharm. Anal. Chem., State Univ., Groningen, The Netherlands). **A rapid and specific method for the determination of traces of thallium directly in urine by differential pulse anodic stripping voltammetry.** *Arch. Toxicol.* 34(2): 137-143; 1975. (11 references)

The applicability of differential pulse anodic stripping voltammetry to the direct qualitative and quantitative analysis of thallium in urine has been investigated. Comparisons were made between the hanging mercury drop electrode and the mercury plated wax impregnated graphite electrode. The latter electrode was found to be somewhat more sensitive, with detection limits in the lower ppb range. For quantitative determination, the hanging mercury drop electrode showed better reproducibility. The effects of toxicologically important metals on the analysis of thallium were investigated and their possible interference could be eliminated by a proper choice of operating conditions. The advantages of the proposed method are its sensitivity, speed and low cost in comparison with other methods for detecting and measuring thallium. (Author abstract by permission)

76-1051. Harzer, K.; Barchet, R. (Chem. Untersuchungsamt Stadt Stuttgart, Stuttgart, Germany). **Nachweis und Bestimmung von Parathion und *p*-Nitrophenol in biologischem Material. [Detection of parathion and *p*-nitrophenol in biological material by reverse phase high-pressure liquid chromatography]** *Arch. Toxicol.* 34(3): 47-52; 1975. (11 references) (German)

Reverse-phase high-pressure liquid chromatography was used to detect parathion in gastric contents and blood of a woman who committed suicide and *p*-nitrophenol in her kidneys. In the second suicide victim, a man, *p*-nitrophenol was detected in the urine. The parathion in the gastric contents was determined quantitatively both directly and after hydrolysis to *p*-nitrophenol. The mobile phase was methanol/water. The results were verified by gas chromatography and spectrophotometry. Other organophosphates are less likely to interfere in determination of parathion by HPLC than by other methods. (Author abstract by permission, edited)

76-1052. Pryde, A. (Wolfson Liquid Chromatogr. Unit, Dep. Chem., Univ. Edinburgh, Edinburgh, Scotland). **Biochemical applications of high-pressure liquid chromatography.** *Biochem. Soc. Trans.* 3(6): 864-867; 1975. (8 references)

High-pressure liquid chromatography (HPLC) was applied to the analysis of the herbicide paraquat in whole human urine and to a study of nucleotide (ADP and ATP) concentrations in blood platelets during aggregation. With the HPLC method, a urine sample may be injected directly onto the column and the formation of derivatives of paraquat is not required. Paraquat is separated from the endogenous urinary components and detected at 258 nm, where it has a uv-absorbance maximum. Quantitative determination of the paraquat in various samples was carried out via measurement of the area of the paraquat peak by triangulation and comparison with standards. In samples containing large quantities of paraquat (21,800 μg/liter), a 2 μliter injection volume gave a sufficiently strong paraquat peak, whereas with more dilute samples (100-2650 μg/liter), a large volume of urine (50 μliter) was injected. Diquat did not interfere with the determination of paraquat. The coefficient of variation of the paraquat determination (n = 10) at a paraquat concentration of 1000 μg/liter was 6.6% and the recovery of paraquat from urine was within these limits. The results obtained by the HPLC method agreed fairly well with those obtained colorimetrically.

76-1053. Elcombe, C. R.; Bridges, J.; Nimmo-Smith, R. H.; Werringloer, J. (Dep. Biochem., Univ. Surrey, Guildford, Surrey, England). **Cumene hydroperoxide-mediated formation of inhibited complexes of methylenedioxyphenyl compounds with cytochrome P-450.** *Biochem. Soc. Trans.* 3(6): 967-970; 1975. (13 references)

It was previously demonstrated that when microsomal preparations, fortified with NADPH, were incubated under aerobic conditions with certain methylenedioxphenyl compounds, characteristic absorption maxima at 427 and 455 nm were observed in the difference spectrum. In the present study, it was found that the absorbing complex of the 427 nm-absorbing and 455 nm-absorbing component disappeared after removal of the reducing conditions and that a single absorption maximum at 438 nm appeared. The 438 nm absorption maximum was also obtained following the addition of cumene hydroperoxide to the microsomal suspension. On readdition of the reducing agent, the 427 and 455 nm absorption maxima immediately reappeared. Thus, it seemed that the 438 nm-absorption maximum represented the difference spectrum due to the oxidized methylenedioxyphenyl metabolite-cytochrome P-450 complex, and the 427 and 455 nm absorption maxima were the optical manifestations of the metabolite-cytochrome P-450 complex in the reduced state. The data indicates that the use of cumene hydroperoxide for the generation of the oxidized forms of methylenedioxyphenyl metabolite-cytochrome P-450 complexes could be of considerable value in the further study of stable complexes of cytochrome P-450 with metabolic intermediates.

76-1054. Selim, S. I. (Univ. California, Davis, CA). **The control of snail and slug pests in agriculture. Part 1. Analysis**

for and dissipation of metaldehyde in vegetable crops. Part II. Beer as a slug attractant. *Diss. Abstr. Int. B* 35(1): 4; 1974.

A simple and sensitive gas chromatographic method is described for the analysis of residues of the molluscicide metaldehyde in crop tissue. After extraction with benzene and cleanup on Florisil, metadehyde was converted to acetaldehyde, which was determined as its 2,4-dinitrophenylhydrazone derivative using alkali-flame ionization gas chromatography. Recoveries of 94 to 102% were obtained for artichoke and strawberry samples fortified at 0.1, 1, and 10 ppm. Aldehydes and ketones may be determined individually by analysis of the sodium bisulfite extract of the benzene solution. When metaldehyde was applied as a wettable powder at 3 lb/acre on strawberries or as a wettable powder or dust on artichokes a 14 day waiting period was sufficient to lower the residue below the detection limit of 0.1 ppm. Bait formulations persisted longer. The residue dissipation pattern suggested contamination of the berries by pickers and/or bait in the vicinity of the berries. In a thin film or a saturated solution under UV light and heat, metaldehyde may vaporize intact or be converted to its decomposition product acetaldehyde. Acetaldehyde under UV irradiation is known to give peracetic acid which in turn is converted to acetic acid, a nontoxic and natural constitutent of the environment. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 74-16,291.)

76-1055. Girenko, D. B.; Klisenko, M. A. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pesticides, Polymers and Plastics, Kiev, USSR). **Gazokhromatograficheskiy analiz gerbitsidov gruppy anilidov karbonovykh kislot. [Gas chromatographic analysis of herbicides from the group of carboxylic acid anilides.]** *Gig. Sanit.* 11: 59-61; 1974. (4 references) (Russian)

A gas chromatographic method is described for determining the carboxylic acid anilide derived pesticides stam (propanil), solan and dicryl in water and air. Ether or *n*-hexane is best for the extraction of these pesticides from water or from air filters. A gas chromatograph with electron capture detector, a column temperature of 170°C, a detector temperature of 190°C, an evaporator temperature of 200°C, and a nitrogen flow rate of 70 ml/min are the optimal conditions for gas chromatographic analysis. The smallest detectable quantity amounts to 0.005 μg for stam, 0.01 μg for solan, and 0.002 μg for dicryl. The recovery rates are between 77 and 90%.

76-1056. Mendoza, C. E. (Health Protect. Br., Dep. Natl. Health Welfare, Ottawa, Ontario, Canada). **Enzyme inhibition and chromatographic techniques: comparative studies and application to pesticide residue analysis.** *Int. J. Environ. Anal. Chem.* 3(3): 171-183; 1974. (30 references)

The thin-layer chromatographic-enzyme inhibition (TLC-EI) technique can be used for simultaneous determination of several pesticides as well as parent compounds and their metabolites, and can detect organophosphorus and carbamate pesticides at pg and ng levels. It can be used for samples containing interferences too great for gas-liquid chromatography (GLC) and to isolate a compound prior to GLC analysis. However, the sensitivity of the technique varies according to several parameters, including the type and thickness of the gel layer, the enzyme and enzyme substrate, and the temperature and humidity of the chromatographic room. Electron capture (EC) detection is generally a very sensitive method for the P(S) and organochlorine pesticides, flame photometric detectors are specific for P and S, microcoulometric detectors can be specific for N-, S-, and Cl-containing compounds, and the TLC-EI technique is very sensitive to P(O) and carbamate pesticides. The latter does not usually detect the P(S) and OC compounds. Some samples can be analyzed by TLC-EI without cleanup; when cleanup is required, it is time consuming and presents problems in terms of loss of residues and a greater chance of encountering more interference from solvents and clean-up columns. The inhibition patterns of beef, sheep, pig, monkey, and chicken liver esterases by seven organophosphorus pesticides and carbaryl were studied using the TLC-EI technique. The technique was also applied to the detection of nine carbamates, the analysis of freeze-dried liver extracts, the determination of pesticide residues in peas and carrots, and the detection of methomyl in rapeseeds, oils, and meals.

76-1057. Greenhalgh, R.; Cochrane, W. P. (Chem. Biol. Res. Inst., Res. Br., Agr. Canada, Ottawa, Ontario, Canada). **Optimisation of the sulphur phosphorus emission detector and comparison with the electrolytic conductivity detector to some sulphur-containing insecticides and herbicides.** *Int. J. Environ. Anal. Chem.* 3(3): 213-228; 1974. (13 references)

The flame parameters of the sulfur phosphorus emission detector (SPED) were examined for maximum response to a thiocarbamate, a phosphate, and a phosphorothioate under a given set of gas chromatographic conditions. An oxygen flame was preferred for the sulfur compound, with an oxygen:hydrogen ratio of 0.2-0.25 and a low hydrogen flow of 100-150 ml/min, whereas for the phosphorus compounds an air flame gave the best results with an oxygen:hydrogen ratio of 0.1-0.15 and a hydrogen flow of 200 ml/min. The response of the SPED was similar to that of other flame photometric detectors in that it gave a linear response in the phosphorus mode, a squared relationship in the sulfur mode for sulfur compounds, and a quadratic response for compounds that contained both phosphorus and sulfur. With the latter, the amount of cross-channel interference in the sulfur mode from phosphorus was greatly reduced when an air flame was employed. A comparative study of the response of 31 sulfur-containing compounds with the SPED and Coulson electrolytic conductivity detector (CCD) showed the latter to be more sensitive by a factor of three; however, it was not specific. Of all the compounds studied, supracid

(methidathion) and its metabolite were the only ones which gave anomalous responses. The thiodiazolidyl sulfur atom did not appear to give S_2 on combustion, whereas it could be detected by the CCD in the pyrolytic mode.

76-1058. Slade, P. (ICI Plant Protection Div., Jealott's Hill Res. Stn., Bracknell, Berks, England). **IUPAC commission on the development, improvement, and standardization of methods of pesticide residue analysis.** *J. Assoc. Off. Anal. Chem.* 58(6): 1244-1255; 1975. (21 references)

The proceedings are summarized of the seventh meeting of the IUPAC Commission on the Development, Improvement, and Standardization of Methods of Pesticide Residue Analysis, held in Munich in August 1973. Methods were reported for the extraction, cleanup, analysis, and confirmation of organochlorine pesticide residues, with emphasis on the polychlorinated biphenyls, terphenyls, dibenzo-*p*-dioxins, and dibenzofurans. Extraction, cleanup, and analytic methods for multiple and single organophosphorus and carbamate pesticide residues were also discussed. Particular attention was given to use of thin-layer and gas chromatographic methods for the analysis of multiple organophosphorus residues. Fumigant residue analysis was discussed with respect to residues resulting from the use of phosphine and methyl bromide and with respect to unchanged fumigants, and methods were presented for the analysis of various fungicide residues, including benomyl, carbendazim, thiabendazole, thiophanate, fuberidazol, pyrazophos, and pyracarbolid.

76-1059. Hill, K. R. (Agric. Environ. Qual. Inst., Beltsville, MD 20705). **IUPAC Commission on Terminal Residues.** *J. Assoc. Off. Anal. Chem.* 58(6): 1256-1285; 1975. (275 references)

An account is presented of the proceedings of the seventh meeting of the IUPAC Commission on Terminal Residues, held in Munich in August 1973. Among the terminal organochlorine compound residues evaluated with respect to metabolism and stability were lindane, hexachlorobenzene, aldrin and dieldrin, and various other cyclodiene insecticides. Various terminal organophosphorus compound residues were also evaluated, including methyl parathion, azinphosmethyl, parathion, diazinon, cyanophos, phoxim, mocap, (ethoprop) fenitrothion, monocrotophos, and methidathion. Terminal carbamate residues evaluated were carbaryl, *p*-chlorophenyl methyl carbamate (CPMC), aldicarb, carbofuran, Bux (metalkamate), aminocarb, Zectran (mexacarbate), mesurol (methiocarb), Meobal, carbanolate, UC-34096, and *m-tert* butylphenyl methylcarbamate. Various terminal fumigant and terminal acaricide residues were also evaluated; included among the fungicide residues were ethylenethiourea and organotin compounds. TCDD, diquat, and chlormequat were among the terminal herbicide residues evaluated.

76-1060. Reeder, S. K. (Prod. Res. Develop. Div., Sunkist Growers Inc., Ontario, CA 91761). **High-speed chromatographic determination of *o*-phenylphenol residues in citrus products.** *J. Assoc. Off. Anal. Chem.* 59(1): 162-164; 1976. (6 references)

A method is presented for the quantitative analysis of *o*-phenylphenol residues in citrus oils, encapsulated flavors, and dried meal. The method utilizes high-speed liquid chromatography for the determination after specific sample preparations for each material. These preparations include hexane extraction of acidified basic extracts or steam distillation and extraction. The limit of the analysis is < 1 ppm with an analysis time of < 45 min. (Author abstract by permission)

76-1061. Dale, W. E.; Miles, J. W. (Bur. Tropical Diseases, Cent. Disease Contr., Atlanta, GA 30333). **Partition chromatographic separation of pesticide residues from fats.** *J. Assoc. Off. Anal. Chem.* 59(1): 165-168; 1976. (9 references)

A simple, rapid, and efficient partitioning column consisting of acetonitrile on Florisil has been developed for the separation of pesticides from fish, beef, and butter fat. The efficiency of the cleanup column is between 97 and 100%. Nine pesticides having partition coefficients between *n*-hexane and acetonitrile of $\leqslant 0.05$ were satisfactorily separated from fat with good recoveries. When the column was used to clean up temophos in a fish extract, 99.91% of the fat was eluted with 20 ml *n*-hexane with no loss of the pesticide. (Author abstract by permission)

76-1062. Finsterwalder, C. E. (Food Drug Admin., Cincinnati, OH 45202). **Collaborative study of an extension of the Mills et al. method for the determination of pesticide residues in food.** *J. Assoc. Off. Anal. Chem.* 59(1): 169-171; 1976. (9 references)

Fifteen laboratories collaboratively determined parathion, *o,p'*-DDT, *p,p'*-DDT, and *p,p'*-DDE in kale, and lindane, dieldrin, heptachlor epoxide, and *p,p'*-DDE in eggs, using electron capture gas-liquid chromatography (potassium chloride thermionic detector for parathion). Pesticide levels ranged from 0.033 ppm heptachlor epoxide to 3.32 ppm *p,p'*-DDT. Mean recoveries (± standard deviations) were: parathion 91 ± 15%, *o,p'*-DDT 99 ± 8%, *p,p'*-DDT 97 ± 8%, lindane 94 ± 4%, dieldrin 106 ± 8%, heptachlor epoxide 106 ± 5%, *p,p'*-DDE 94 ± 8% in eggs and 101 ± 9% in kale. The methods have been adopted as official first action. (Author abstract by permission)

76-1063. Francoeur, Y.; Mallet, V. (Dep. Chem., Univ. Moncton, Moncton, New Brunswick, Canada E1A 3E9). **Determination of quinomethionate (6-methylquinoline-2,3-diyldithiocarbonate) residues in crops by *in situ* fluorometry.** *J. Assoc. Off. Anal. Chem.* 59(1): 172-173; 1976. (10 references)

A simple method is described for the quantitative

determination of quinomethionate (6-methylquinoline-2,3-diyldithiocarbonate) in crops. The pesticide residue is extracted with acetonitrile and partitioned in petroleum ether. After separation from the co-extractives by thin layer chromatography (TLC), the fluorescence is measured directly on a silica gel TLC plate. An average of 89% recovery is obtained at the 0.05 ppm level in apples, peaches, pears, and tomatoes. (Author abstract by permission)

76-1064. Johnson, L. D.; Waltz, R. H.; Ussary, J. P.; Kaiser, F. E. (Anal. Biochem. Lab. Inc., Columbia, MO 65201). **Automated gel permeation chromatographic cleanup of animal and plant extracts for pesticide residue determination.** *J. Assoc. Off. Anal. Chem.* 59(1): 174-187; 1976. (6 references)

Applications of an improved gel-solvent system for cleanup of pesticide residues by gel permeation chromatography (GPC) were investigated. Elution characteristics using Bio-Beads SX-3 gel and a toluene-ethyl acetate (1+3) elution solvent were determined for 16 nonionic chlorinated pesticides, 3 polychlorinated biphenyls (PCBs), 14 chlorophenoxy herbicide esters, and 7 organophosphate insecticides. Elution patterns for vegetable and animal lipids were also studied. Quantitative recoveries of the pesticides were achieved. No liquid-liquid partitioning cleanup steps were required with any type of nonionic chlorinated pesticide or sample matrix. Only GPC cleanup was required for the nonionic chlorinated pesticides, PCBs, and organophosphate pesticide residues in chicken and turkey fat samples. Electron capture and flame photometric detectors were used in the gas chromatographic method for the respective pesticides. Samples containing up to 0.5 g lipid each were processed at the rate of one every 30-40 min with the automated system. Results were in excellent agreement with those from accepted manual partitioning methods and were achieved with significant savings of both labor and chemicals. (Author abstract by permission)

76-1065. Coburn, J. A.; Ripley, B. D.; Chau, A. S. Y. (Water Qual. Br., Canada Cent. Inland Waters, Burlington, Ontario, Canada). **Analysis of pesticide residues by chemical derivatization. II. *N*-methylcarbamates in natural waters and soils.** *J. Assoc. Off. Anal. Chem.* 59(1): 188-196; 1976. (39 references)

A method for the quantitative determination of several *N*-methylcarbamates in natural waters and the applicability of the derivative to soil samples using a previously published extraction procedure are described. After extraction of the carbamates from the substrate, the carbamates are hydrolyzed in a 10% methanol-potassium hydroxide solution to form the phenolic hydrolysis products, which are isolated and derivatized with pentafluorobenzyl (PFB) bromide to produce the PFB ether derivatives. The PFB derivatives are cleaned up and fractionated on a silica gel microcolumn and determined by electron capture gas-liquid chromatography (GLC). Eight organophosphate pesticides and 2 phthalate acid esters that hydrolyze to phenols or phthalic acid were evaluated as potential interferences and were found not to interfere with any of the carbamates tested. Quantitative determinations of 0.1 μg carbofuran and 3-ketocarbofuran and 0.5 μg carbaryl, metmercapturon, and Mobam in a 1 liter water sample are possible. Propoxur was not determined at levels <1 μg/l due to the short GLC retention time of the derivative and interferences from the reagents at the lower levels. (Author abstract by permission)

76-1066. Nicholas, M. L.; Powell, D. L.; Williams, T. R.; Bromund, R. H. (Dep. Chem., Coll. Wooster, Wooster, OH). **Reference Raman spectra of DDT and five structurally related pesticides and of five pesticides containing the norbornene group.** *J. Assoc. Off. Anal. Chem.* 59(1): 197-208; 1976. (7 references)

The Raman spectra of DDT and 5 structurally related pesticides, TDE (DDD), Perthane, methoxychlor, dicofol, and tetradifon, and of 5 pesticides containing the norbornene group, heptachlor, chlordane, dieldrin, endrin, and endosulfan, have been recorded. These spectra are presented, along with tables giving values for the frequencies. (Author abstract by permission)

76-1067. Barney, J. E., II (Richmond Res. Cent., Stauffer Chem. Co., Richmond, CA 94804). **Second collaborative study of a gas-liquid chromatographic method for the assay of thiocarbamate formulations.** *J. Assoc. Off. Anal. Chem.* 59(1): 213-215; 1976. (4 references)

A gas-liquid chromatographic (GLC) method previously evaluated for the assay of 6 thiocarbamate herbicides in formulations has been tested on 2 new formulations containing Eptam (EPTC) and Sutan (butylate) plus a safener. The method was tested collaboratively by 17 laboratories. The coefficient of variation for 4 formulations was 4.10%. Most of the error is systematic. It is recommended that the present method, 6.367-6.371, be continued as official first action, and that other GLC stationary phases be evaluated. (Author abstract by permission)

76-1068. Siquiroff, M.; Pollero, R.; Goyena, R. (Inst. Biol. Lab. Salud Publ., La Plata, Argentina). **Volumetric determination of malathion, using dichlorofluorescein as indicator.** *J. Assoc. Off. Anal. Chem.* 59(1): 216-218; 1976. (13 references)

A method has been developed which is based on alkali cleavage of malathion and volumetric determination of the resulting dimethylphosphorodithioate with silver nitrate, using dichlorofluorescein as the indicator. Pure malathion standards were analyzed by the proposed method, yielding a standard deviation of 0.27. Four typical malathion formulations containing talc, wheat flour, and anionic and nonionic emulsifiers were analyzed by both

the proposed method and the former official first action colorimetric method with comparable results. Potential interferences from surfactants currently employed in liquid formulations are avoided by the use of Florisil column chromatography. Malathion is eluted from the column with petroleum ether-ethyl ether with an average recovery of 92.5%. (Author abstract by permission)

76-1069. Lea, R. (Country Pride Foods, El Dorado, AR). **Separation of pesticide residues from lipids prior to gas-liquid chromatographic analysis.** *J. Assoc. Off. Anal. Chem.* 59(1): 224-225; 1976. (9 references)

Lipids are separated from dieldrin, endrin, and *p,p'*-DDE residues by saponification in ethanolic sodium hydroxide, acidification with dilute sulfuric acid, and adsorption chromatography on deactivated alumina, using petroleum ether as the eluant. Dieldrin, endrin, and *p,p'*-DDE are efficiently recovered (95—102%), and *p,p'*-DDT is converted to *p,p'*-DDE, which is then recovered with high yield (90-96%). Extremely low lipid carryover (< 0.3-0.5%) is observed for 0.5-1.0 g samples of chicken fat. (Author abstract by permission)

76-1070. Drozd, J. (Inst. Anal. Chem., Czechoslovak Acad. Sci., Brno, Czechoslovakia). **Chemical derivatization in gas chromatography.** *J. Chromatogr.* 113(3):303-356; 1975. (604 references)

Gas chromatography has proved useful in the analysis of chlorinated hydrocarbons, organophosphorus and organosulfur compounds, carbamates, heterocyclic derivatives and other substances. The decomposition of chlorinated insecticides on the column and the presence of polar groups, especially hydroxyl groups, in the molecules of some insecticides favor the preparation of chemical derivatives. Partial dechlorination of insecticides of the chlordane type with bases and conversion into uniform acetyl, TMS, and/or *tert*-butyl derivatives gives single peaks with good shapes in the chromatogram of each individual compound. Direct analysis has been made of insecticides that had been partially dechlorinated with potassium hydroxide, whereas endrin and dieldrin were saturated with hydrogen chloride prior to gas chromatography. Individual compounds were identified by chromatographing them after derivatization and in the free state on two stationary phases and comparing the retention data. Diverse derivatives have been prepared for carbamates. Some analysts have hydrolyzed carbamates with alkali metal hydroxide to the corresponding phenols, which were further converted by reaction with dimethoxythiophosphate into the dimethoxythiophosphoryl derivatives. These derivatives display good properties for gas chromatography. Some procedures have called for condensation of the methylamine or dimethylamine groups liberated by hydrolysis with 1-fluoro-2,4-dinitrobenzene and subsequent determination of the resulting dinitroaniline with high precision using an electron capture detector.

76-1071. Hoshika, Y. (Aichi Environ. Res. Cent., Aichi, Japan). **Gas chromatographic determination of the lower aliphatic primary amines as their Schiff bases.** *J. Chromatogr.* 115(2): 596-601; 1975. (20 references)

To permit gas chromatographic (GC) analysis of the lower aliphatic primary amines, the amines were converted into the corresponding Schiff bases by reaction with benzaldehyde, and the Schiff bases were determined directly by GC. The results indicated that with the use of a 3 m X 3 mm I. D. glass column packed with SE-30, direct GC analysis of the amines offers the best potential for clear separation of the individual amines commonly encountered in organic analysis. The minimum detectable quantities of the Schiff bases were on the order of 60 ng, and the detector response produced a straight-line relationship over a range of 0.2-32 μg. A completely quantitative reaction took place with a benzaldehyde:amine molar ratio of 2:1 and a reaction time of 15 min at room temperature. Ammonia and various other amines did not interfere in the formation of Schiff bases. This method is also applicable to the determination of *n*- and *iso*-type aliphatic primary amines.

76-1072. Buchert, A.; Lokke, H. (Natl. Fd. Inst., Soeborg, Denmark). **Gas chromatographic-mass spectrometric-mass spectrometric identification of phenylurea herbicides after *N*-methylation.** *J. Chromatogr.* 115(2): 682-686; 1975. (12 references)

The methylated products of several phenylurea compounds (linuron, 3-(3-4-dichlorophenyl)-1-methoxyurea, diuron, 3-(3,4-dichlorophenyl)-1-methylurea, 3-(3,4-dichlorophenyl) urea, metoxuron, 3-(3-chloro-4- methoxyphenyl)- 1,1-methylurea, and 3-(3-chloro- 4-methoxyphenyl) urea) were analyzed by gas chromatography-mass spectrometry (GC-MS). For each compound, only one GC peak was detected and the corresponding component was identified from the mass spectrum as the expected *N*-methylated derivative. Thus, the procedure is generally applicable for the *N*-methylation of mono-, di-, and tri-substituted phenylureas, yielding tetra-substituted thermostable derivatives. *N*-methylation of metabolites and the parent phenylurea herbicide resulted in the same compound, so distinctions between the herbicides and their individual metabolites was not possible. However, specific analysis for metabolites and herbicides can be performed on trideutero-methylated derivatives by GC-MS.

76-1073. Lines, D. S.; Brain, K. R.; Ross, M. S. F. (Pharmacognosy Sect., Welsh Sch. Pharm., UWIST, Cardiff, Wales). **Causes and effects of sample loss using a dry capsule injection method for the automated gas chromatographic analysis of pesticide samples.** *J. Chromatogr.* 117(1): 59-69; 1976. (9 references)

The automatic capsule sampling system is said to have many advantages for accurate gas chromatographic analysis. One is that the solvent may be removed by evap-

oration before injection, so that no solvent peak is obtained to interfere with the separation. However, working with aldrin and dieldrin, we have shown that up to 50% of the material can be lost from the capsules by air-drying at normal ambient temperature before injection. These losses occurred only with aldrin and it is suggested that they are connected with its relatively high vapor pressure. Significant amounts of material enter the top third of the capsule which is removed during the sealing process. The losses appear to be due to a combination of adsorption to the capsules, creep up the capsule walls, co-distillation with the solvent, and direct volatilization. Silylation of the capsules was quite effective in reducing these losses. (Author abstract by permission)

76-1074. Tanaka, A.; Fujimoto, Y. (Inst. Pub. Health, Kamiokubo, Urawa, Japan). **Gas chromatographic determination of thiabendazole in fruits as its methyl derivative.** *J. Chromatogr.* 117(1): 149-160; 1976. (12 references)

Quantitative determination of thiabendazole, as its methyl derivative, has been achieved by gas-liquid chromatography with flame ionization detection and a column of 10% of DC-200 on Gas-Chrom Q at 240°. Determination was possible with 10 to 200 ng per μl of the methylated reaction mixture. For determining thiabendazole in fruits, clean-up of the crude extracts by liquid-liquid partition allows satisfactory elimination of interference and permits determination in concentrations down to 0.1 ppm. The recovery of thiabendazole added to fruits at the 0.5-ppm level ranges from 90.3 to 94.9%. The methyl derivative was identified as *N*-methylthiabendazole by its elementary composition, by its melting-point, and by ultraviolet, infrared, mass, and nuclear magnetic resonance spectroscopy. (Author abstract by permission)

76-1075. Himel, C. M. (Dep. Entomol., Univ. Georgia, Athens, GA 90601). **Fluorescent probes in the detection of insecticides in water.** *Natl. Tech. Inform. Serv.*, PB-221 336, 1973, 50 p.

Candidate fluorescent probe molecules for cholinesterase enzymes were synthesized. The feasibility of a new analytical method for determining insecticides in water was evaluated. Fluorescent probes are molecules whose spectral responses are altered by the environment. A fluorescent probe in equilibrium with the active site of cholinesterase enzymes will have emission spectra and quantum yields corresponding to both the free probe and the probe-enzyme complex. Insecticides in water which compete for the active site will displace the probe from its complex and quench the fluorescence of the probe-enzyme complex. The quenching effect is related to the concentration of the insecticides and to the equilibrium constant and quantum yield of the probe-enzyme complex. Insecticides which do not compete with or displace the probe from its complex are not detected. Results are presented for chlorpyrifos, endosulfan, dibrom, diazinon, phorate, paraoxon, methyl parathion, TEPP, azinphos-methyl, ethion, malathion, DDT, heptachlor, dieldrin, DDE, eserine, mexacarbate, and dichlorvos.

76-1076. Alford, A. L. (Environ. Protect. Agency, Southeast. Environ. Res. Lab., Athens, GA). **Environmental applications of advanced instrumental analyses: assistance projects, FY 72.** *Natl. Tech. Inform. Serv.*, PB-223 147 1973, 46 p.

Identification and measurement of aquatic pollutants are discussed under 13 project categories. In most cases these analyses helped to solve, or at least to understand more clearly, the related pollution incident and in some cases provided evidence for enforcement of regulatory legislation. These projects illustrate the need for many different analytical techniques to identify pollution sources. Continued development of new methods and improvement of existing techniques are required. (Author abstract by permission)

76-1077. McGuire, J. M.; Alford, A. L.; Carter, M. H. (EPA, Natl. Environ. Res. Cent., Southeast Environ. Res. Lab., Athens, GA). **Organic pollutant identification utilizing mass spectrometry.** *Natl. Tech. Inform. Serv.*, PB-224 544, 1973, 1973, 51 p.

A system is described for the rapid identification of volatile organic pollutants in water. The system involves computer controlled gas chromatography/mass spectrometry with computerized matching of mass spectra. The system was applied to the analysis of waste effluents and showed many compounds present which had not been detected previously. The compounds detected included: trichlorocyclopentene isomer, hexachlorobutadiene, hexachlorocyclopentadiene, hexachloronorbornadiene isomer, octachlorocyclopentene, heptachloronorbornene isomers (2), chlordene, heptachlor, hexachlor epoxide, chlordane, nonachlor, endrin, and an isomer of endrin. The method can detect polychlorinated biphenyls at concentrations of less than 1 μg/l. To check the practicality of computerized spectra matching as a means of identifying trace contaminants in the environment, a synthetic mixture of four pesticides was prepared. Atrazine, sevin (carbaryl), parathion, and *p,p'*-DDT were dissolved in an organic solvent at concentrations equivalent to those resulting from extraction of a water sample containing them at 1 μg/l. Good matches were obtained with a computerized spectra matching program.

76-1078. Mitre Corporation (McLean, VA). **Compendium of analytical methods, Vol. II, Method Summaries.** *Natl. Tech. Inform. Serv.*, PB-228 425, 1973, 381 p. (39 references)

This compendium presents most of the methods currently used or in recent use for the analysis of pollutants in various media and categories as identified by selected EPA laboratories. The compendium contains one-page summaries of the various methods including information

as to the pollutant analyzed, the medium in which it occurs, and non-quantitative descriptions of the measurement/detection method. Methods are presented for the analysis of pesticides in soils and house dusts, human urine, human tissue (liver, kidney, bone marrow, adrenal, gonads, and brain), animal adipose tissue, human blood or serum, fish blood and brain, water, and air. The methods presented include: electron capture gas chromatography, flame photometric detection, microcoulometry, electron capture detection, gas chromatography, titrimetry, gas liquid chromatography, electrolytic conductivity, microcoulometric titration, and thin layer chromatography.

76-1079. Hallbach, P. E. (Environ. Protect. Agency, Cincinnati OH). **Pesticide residue analysis in water (103.1) training manual.** *Natl. Tech. Inform. Serv.*, PB-238 072, 1974, 282 p.

A training manual is presented which outlines course material for use in pesticide residue analysis in water. The manual includes an introduction to pesticide residue analysis and progresses into advanced use of the gas chromatograph. Specific topics in the manual include: distribution of pesticides in the environment, chemistry of pesticides, behavior of pesticides in the aquatic environment, use of extraction methods in pesticide analysis, use of extraction methods for fruits and vegetables, thin-layer chromatography, gas chromatography, introduction to gas-liquid chromatography, characteristics of the flame ionization detector, quantitation in gas chromatography, special techniques required for analysis of phosphorus and herbicidal compounds, infrared instrumentation, principles of infrared spectroscopy, pesticide residue analysis of fish by infrared spectrophotometry, pesticide residue analysis in complex substrates by infrared spectrophotometry, biomonitoring of industrial effluents, methods of detection of cholinesterase inhibition, principles of column selection and preparation, column packing and conditioning, trouble shooting the gas chromatograph, sampling for pesticide residue analysis, design of a pesticide sampling program for the water environment, collection and preservation of various specimens for pesticide analysis, comparative methodology and quality control, determination of cholinesterase inhibition in fish brain, analysis of water for 2,4-D, analysis of fish and related biological specimens for organochlorine and organophosphorus pesticides, sediment extraction procedure, sampling for pesticides in general organic analysis, method for organochlorine pesticides in industrial effluents, method for polychlorinated biphenyls in industrial effluents, methods for triazine pesticides in industrial effluents, method for *O*-aryl carbamate pesticides in industrial effluents, method for *N*-aryl carbamate and urea pesticides in industrial effluents, and method for chlorinated phenoxy acid herbicides in industrial effluents.

76-1080. Feldmann, C. R. (US EPA, OWPO, Municipal Permits & Operations Div., Natl. Training Cent., Cincinnati, OH 45268). **Instrumental analysis of chemical pollutants (107) training manual.** *Natl. Tech. Inform. Serv.*, PB-238 893, 1974, 282 p.

This manual contains lecture and laboratory outlines dealing with the instrumental analysis of certain pollutants found in water. Topics covered included sample collection and isolation, quality control, mass spectrometry, gas chromatography, infrared emission spectroscopy, and atomic absorption spectrometry. Of specific interest to pesticide analysts are the following topics: extraction *p*-values of pesticides, general procedure for pesticide analysis, analysis of water samples for chlorinated hydrocarbons, and analysis of soil samples for chlorinated hydrocarbon and organophosphorus compounds.

76-1081. Karasek, F. W. (Dep. Chem., Univ. Waterloo, Waterloo, Ontario, Canada). **Fluorescence spectroscopy.** *Res. Dev.* 27(1): 28-34; 1976. (17 references)

The most widely used analytical instrumentation today is that based on UV-visible absorption spectroscopy; the closely related technique of fluorescence spectroscopy offers greater sensitivity, selectivity, and linearity. Fluorescence involves energy changes in singlet electronic states (electron spins paired), as opposed to phosphorescence, which involves energy changes from triplet electronic states (electron spins unpaired) to the singlet ground state. The instrumentation for fluorescence and absorption comprises the same basic elements, two optical systems being necessary. Both excitation and fluorescence spectral regions can be selected by the use of simple filter photometers, but the greatest analytical scope of fluorescence is achieved by the use of spectrophotometers, to give scannable wavelength selection throughout the 200-280 nm region. The analytical aspects of fluorescence spectra differ from absorption spectra in an important respect: the intensity of the fluorescence radiation is directly proportional to the excitation intensity, so that sensitivity can be increased by increasing the excitation intensity. The spectra obtained with a conventional spectrofluorometer are distorted, but a corrected fluorescence excitation spectrum can be used advantageously for those applications normally employing UV-visible methods. Fluoresence lends itself to numerous applications; for example, a very sensitive fluorometric assay technique has been developed which can be used to determine the amounts of TCDD accumulated as a pesticide contaminant in food products. Still wider use of fluorescence is certain in the future.

76-1082. Miyabe, M.; Sakabe, Y.; Nagai, Y.; Moriyama, S. (Nagoya City Inst. Publ. Health, Nagoya, Japan). [**Analysis of pesticide residues by thin-layer chromatography.**] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Jpn.)* 14(6): 643; 1973. (Japanese)

The analysis of organochlorine and organophosphate pesticides by thin layer chromatography was studied. The thin layer plate, treated with nitric acid, was

activated at 130°C for 1 hr. Using this plate, the pesticides were developed with a solvent such as *n*-hexane, benzene, acetone, or pentane. The detection of the pesticides developed was done by a three-stage coloring technique. The first stage consisted of spraying with 0.05% silver nitrate solution, the second stage consisted of spraying with fluorescein, and the last stage was accomplished by treatment with iodine vapor. After treatment with silver nitrate, organochlorine pesticides gave black to gray color spots, while the organophosphate pesticides gave black to white spots. The latter pesticides gave fluorescence with fluorescein treatment under UV light, while the organochlorine pesticides did not give fluorescence under the same conditions. With iodine vapor treatment, the spots attributed to the organochlorine pesticides disappeared into the pink background color, while the organophosphate pesticides were observed as yellow spots, whose color did not dissipate. If the nitric acid treatment of the thin layer plate was extended over a few days, stable *Rf* values could be obtained. As little as 5 to 10 ng dieldrin could be detected by this method.

76-1083. Fukuhara, K.; Takeda, M.; Tanabe, H. (Author address not given). [**Analysis of agricultural drugs in foodstuffs, part 13.**] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 14(6): 644-645; 1973. (Japanese)

An analytical method for chlorodibenzo-*p*-dioxin compounds was studied. In order to increase the detection sensitivity of the compounds by the EC detector, these compounds were chlorinated to the octachloro-compounds by adding sulfonyl chloride, aluminum chloride, and iodine-carbon tetrachloride solution and refluxing these solutions at 70 to 75°C for 2 hr. After the reacted solution was evaporated, water was added and the chloro-compounds were extracted into *n*-hexane which was used as the gas chromatography sample. Chlorination techniques using antimony pentachloride and sulfonyl chloride-antimony pentachloride were also tested; however, the present chlorination method with sulfonyl chloride-aluminum chloride-iodine-carbon tetrachloride was most suitable.

76-1084. Sakai, K.; Kato, R.; Hoshino, K.; Sato, N. (Miyagi Prefectural Inst. of Public Health, Sendai, Japan). [**A study on analysis of carbamate insecticides.**] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 14(6): 645; 1973. (Japanese)

The simultaneous analysis of various carbamate insecticides in food was studied by gas chromatography with an electron capture detector. The insecticides analyzed were MTMC, CPMC, MIPC, XMC (meobal), MPMC, BPMC (osbac), PHC, EMPC, NAC (carbaryl), and APC, which were separated using various GC columns. The food extracted substances were dissolved in methanol, to which 1 *N* NaOH-methanol solution was added. After methanol was evaporated from the system, the residue was dissolved in 10 ml of 0.25 *N* NaOH solution from which the carbamate insecticides were extracted into 10 ml of 2% trifluoroacetic acid-benzene solution, and the benzene phase was injected onto the GC. Of 16 columns tested, 5% DOS, 5% TCP, and 5% DEGS-1% H_3PO_4 columns gave better insecticide separations compared to other GC columns. With 5% DOS column, all the above insecticides except EMPC, NAC, and APC eluted within 20 min: however, APC did not elute within 120 min. The same results were obtained with the 5% TCP column, although the MTMC and CPMC peaks overlapped. With an optimum column temperature, the 5% DEGS – 1% H_3PO_4 column could elute EMPC, NAC, and APC within 20 min in good peak separations.

76-1085. Sekita, H.; Suzuki, T.; Takeda, M. (Nat. Hyg. Lab., Tokyo, Japan). [**Analysis of agricultural drugs in foodstuffs, part 14.**] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 14(6): 646; 1973. (Japanese)

The analytical technique for carbamate insecticide residues in foods is described. The insecticides studied were NAC (carbaryl), CPMC, MTMC, MIPC, BPMC (osbac), PHC, MPMC, XMC (meobal), and APC. The gas chromatograph used was equipped with an EC detector with a 1.5 m long 5% XE-60 column at 170°C. Residue extraction was first done with dichloromethane; the extract was dried and dissolved in *n*-hexane. The resulting *n*-hexane solution was extracted with acetonitrile and the residues were dried and dissolved in fresh *n*-hexane. After the same extraction procedure was repeated, the *n*-hexane solution was passed through an alumina column which was then developed with a 10% acetone-*n*-hexane solvent. After evaporation of the acetone-*n*-hexane solvent, the residues were dissolved in ethyl acetate and trifluoroacetylation was done by adding trifluoroacetic anhydride, to which ether and *n*-hexane were added. The solution was rinsed with water, diluted with *n*-hexane, and used as the GC sample solution. The detection limit by this method was 0.006 to 0.008 ng for BPMC, MTMC, and MIPC, 0.01 to 0.02 ng for CPMC, MPMC, PHC, and XMC, and 0.15 ng for NAC. The recovery of 1 ppm insecticides added to unhulled rice was determined by the above technique. The recovery obtained ranged between 86% for CPMC and 108% for NAC.

76-1086. Miyata, H.; Kashimoto, T. (Osaka Prefect. Inst. Publ. Health, Osaka, Japan). [**Analysis of carbamates in agricultural products.**] *Shokuhin Eiseigaku Zasshi (J. Food Hyg. Soc. Jpn.)* 14(6): 646-647; 1973. (Japanese)

A gas chromatographic analytical technique for carbamate insecticide residue in agricultural products was studied. The insecticides studied were MTMC, CPMC, BPMC (osbac), MPMC, and NAC (carbaryl). The GC sample preparation involved insecticide residue extraction from agricultural products with benzene, followed by adsorption on an activated Florisil column. Methylene chloride was used to elute the insecticides from the column, and after the methylene chloride was evaporated, the

residue was dissolved in acetone. The acetone solution was then passed through an activated carbon column, and the adsorbed substance was eluted with fresh acetone. After acetone was evaporated, the residue was dissolved in ether, and trifluoroacetic anhydride and *n*-hexane were added. After the solution was rinsed with water, it was diluted with *n*-hexane and used for the GC injection. The GC analysis was performed with an electron capture detector and a 3.5% OV-17 column at 142°C and a carrier gas flow rate of 20 ml/min. The relative retention times of the insecticides observed with respect to γ-BHC (lindane) was 0.18, 0.25, 0.33, 0.37, and 1.78 for MTMC, CPMC, BPMC, MPMC, and NAC respectively. The above technique was used to assess the recovery of 0.133 ppm of each insecticide added to potato, orange, strawberry, Chinese cabbage, sweet potato, burdock, loquat, and white muskmelon. Satisfactory recovery could be achieved by this technique. The highest trifluoroacetylation efficiency could be obtained from ether, compared to acetone, benzene, ethyl acetate, and methylene chloride, which were also examined.

76-1087. Marriage, P. B. (Res. Stn., Agric. Canada., Harrow, Ontario, NOR 1GO). **Detection of triazine and urea herbicide residues by various characteristics of oat seedlings in bioassays.** *Weed Res.* 15(5): 291-298; 1975. (22 references)

Atrazine, simazine, diuron, and linuron applied to soil increased the percentage moisture of oat (*Avena sativa* L.) shoots in bioassays at the lowest dose tested of 0.25 ppm. Further increases occurred up to 2 ppm but at higher concentrations the percentage moisture decreased. At all doses of each herbicide, shoot dry weight was decreased. In oats grown on soil collected from a peach orchard which had received repeated annual applications of these herbicides, the percentage moisture of the oat shoots was higher than the control value whenever the oat dry weight was decreased and provided a method of residue detection as sensitive as dry weight measurements. Treatment of oats caused increases in the electrical conductivity of an aqueous extract of the oat shoots per mg of dry weight and this characteristic was slightly more sensitive than dry weight in detecting herbicides in orchard soil. The conductivity of the extract per mg of water in the shoots, however, only increased as percentage moisture decreased. The weight of neutral water-soluble material in oat shoots decreased much more rapidly than dry weight in bioassays with standard herbicide concentrations. Determination of the weight of neutral water-soluble material in oat plants grown on orchard soil samples indicated the presence of herbicide residues in 50% of the cases in which residues were not detectable by dry weight. The weight of neutral material as a percentage of dry weight was almost as sensitive. Chemical analysis of soil in which oat plants had a decreased level of neutral water-soluble compounds indicated that this characteristic had a lower limit of detection for herbicide residues of approximately 0.10 ppm. (Author abstract by permission)

76-1088. Harvey, G. R. (Woods Hole Oceanographic Inst., Woods Hole, MA 02543). **Adsorption of chlorinated hydrocarbons from seawater by a crosslinked polymer.** *Natl. Tech. Inform. Serv.*, PB-227 349, 1973, 35 p.

A synthetic resin, Amberlite XAD-2, was evaluated as an adsorption medium for chlorinated hydrocarbons dissolved in seawater. The resin appeared to be an excellent adsorbent for chlorinated hydrocarbon contaminants in seawater. The resin should work quite well with fresh water, but the "salting out" effect of seawater probably makes the high flow rates possible. XAD-2 resin has two advantages over polyurethane foam and reversed phase liquid-liquid chromatography. In the first place, there is no organic coating on the XAD-2, so that after elution of the column it is ready to be reused. In the second place, the XAD-2 has excellent pressure resistance, so that it can be used in in situ columns at depth. XAD-2 has been tested at 1000 m and no compression of the spheres was noted. It is felt that the system described should be flexible enough for any natural water monitoring of ambient levels of chlorinated hydrocarbons. XAD-2 has been used to monitor the water of the open North Atlantic Ocean. In this work 20-80 liters of seawater was pumped through the 50 cc column. The efficiency of the column was found to be greater than 95%. It is suggested that one use of the resin which could be exploited for coastal monitoring is in situ sampling from a ship underway.

The Administrator of the U.S. Environmental Protection Agency has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Agency. Use of funds for printing this periodical approved by the Director of the Office of Management and Budget February 6, 1973.

Pesticides Abstracts is available on 16 mm microfilm. Additional information can be obtained from the Technical Services Division.

ORDER FORM FOR
PESTICIDES ABSTRACTS

To: Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Please enter my subscription for Pesticides Abstracts. I am enclosing Money Order ☐ Check ☐ for this subscription.
($18.25 a year; $4.60 additional for foreign mailing.)

Please address as follows: _____

_____

_____

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 1968

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Subscription price, domestic, $18.25 a year, $4.60 additional for foreign mailing. Price for a single copy of this issue is $1.40, Index issue $2.35.

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDE PROGRAMS
TECHNICAL SERVICES DIVISION
RM. EB-49, 401 M STREET, S.W.
WASHINGTON, D.C. 20460

POSTAGE AND FEES PAID
FOURTH CLASS RATE BOOK
EPA-335

U.S.MAIL

MISC.

Serials Department
Xerox University Microfilms
300 North Zeeb Road
Ann Arbor, MI 48106 EPA 18-1

If you do not desire to continue receiving this publication, please CHECK HERE ☐ ; cut off this label and return it to the above address. Your name will then be removed from the mailing list.